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SUSQUEHANNA RIVER BASIN
TRIBUTARY TO CHOCOMUT CREEK
SUSQUEHANNA COUNTY

PENNSYLVANIA

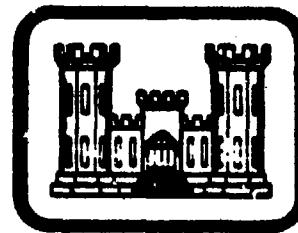
LONGFORD LAKE DAM

NDI ID NO. PA-00898
DER ID NO. 58-137

SILVER LAKE ENTERPRISES

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PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



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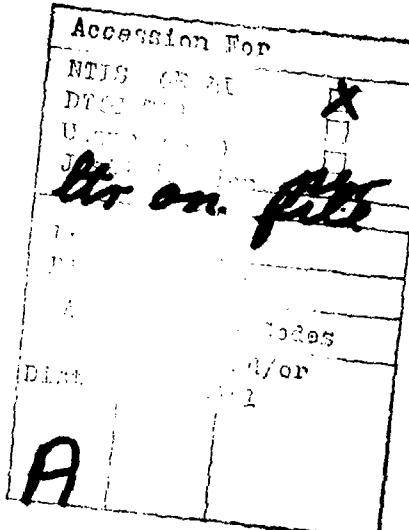
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SUSQUEHANNA RIVER BASIN
TRIB. TO CHOCONUT CREEK, SUSQUEHANNA COUNTY
PENNSYLVANIA

LONGFORD LAKE DAM

NDI ID No. PA-00898
DER ID No. 58-137

SILVER LAKE ENTERPRISES



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared By:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

SEPTEMBER 1981

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

CONTENTS

| <u>Description</u> | <u>Page</u> |
|---|-------------|
| Brief Assessment of General Condition and Recommended Action..... | iii |
| SECTION 1 - Project Information..... | 1 |
| SECTION 2 - Engineering Data..... | 5 |
| SECTION 3 - Visual Inspection..... | 6 |
| SECTION 4 - Operational Procedures..... | 8 |
| SECTION 5 - Hydrology and Hydraulics..... | 9 |
| SECTION 6 - Structural Stability..... | 11 |
| SECTION 7 - Assessment, Recommendations, and Proposed Remedial Measures..... | 13 |

APPENDICES

| <u>Appendix</u> | <u>Title</u> |
|-----------------|-------------------------------|
| A | Checklist - Visual Inspection |
| B | Checklist - Engineering Data |
| C | Photographs |
| D | Hydrology and Hydraulics |
| E | Plates |
| F | Geology |

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
BRIEF ASSESSMENT OF GENERAL CONDITION
AND
RECOMMENDED ACTION

Name of Dam: Longford Lake Dam
NDI ID No. PA 00898
DER ID No. 58-137

Size: Small (37.2 feet high; 355 acre feet)

Hazard Classification: High

Owner: Silver Lake Enterprises
Endicott, New York

State Located: Pennsylvania

County Located: Susquehanna

Stream: Tributary to Choconut Creek

Date of Inspection: 24 March 1981

The visual inspection and review of available design and construction data indicate that Longford Lake Dam is in good condition. In accordance with the guidance provided, the spillway design flood (SDF) ranges between 1/2 the PMF and the full PMF. Based on the size and extent of downstream hazard for the dam, the SDF selected for this facility was the PMF.

The hydrologic and hydraulic computations indicate that the combination of reservoir storage and spillway discharge capacity will pass 88% of the PMF prior to overtopping the embankment. Therefore, in accordance with the recommended criteria for Phase I inspections, the spillway for Longford Lake Dam is considered to be inadequate.

It is recommended that the following actions be taken by the owner without delay:

1. The operational condition of the pond drain should be determined.
2. The wet areas near the embankment toe should be monitored, and appropriate remedial measures taken should any significant changes in turbidity or flow rate be observed.

LONGFORD LAKE DAM

3. The natural drainage ditch at the left abutment should be riprapped to protect against erosion of the spillway channel.
4. The rodent hole in the embankment should be backfilled.
5. A formal surveillance and downstream emergency warning system should be developed for use during periods of heavy or prolonged precipitation.
6. An operation and maintenance manual or plan should be prepared for use as a guide in the operation and maintenance of the dam during normal and emergency conditions.
7. A schedule of regular inspection by a qualified engineer should be developed.

Approved By:
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE: 18 Sep 1981

LONGFORD LAKE DAM



OVERVIEW

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-567, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of non-federal dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 Description of Project

a. Description of Dam and Appurtenances. Longford Lake Dam is an earth-fill structure approximately 37.2 feet high and 878 feet in length (including spillway). The 20 foot wide spillway is an uncontrolled trapezoidal broad-crested weir located at the left abutment of the dam. The outlet works consist of a 24 inch diameter reinforced concrete conduit through the embankment with a concrete riser and pond drain on the reservoir side. The 24 inch conduit discharges into a reinforced concrete impact-type energy dissipater.

NOTE: All elevations in this report are referenced to U.S.G.S. Quad Sheet entitled Laurel Lake, Pa. - N.Y. Datum is the crest of the outlet works riser, which is the normal pool elevation of 1580, interpolated from the Quad Sheet.

b. Location: Silver Lake Township, Susquehanna County, Pennsylvania
U.S.G.S. Quadrangle - Laurel Lake, Pennsylvania - New York
Latitude $41^{\circ} 57.3'$; Longitude $75^{\circ} 58'$
Refer to Plates E-I and E-II.

c. Size Classification: Small: Height - 37.2 feet
Storage - 355 acre-feet.

d. Hazard Classification: High (Refer to Sect 3.1.e)

e. Ownership: Silver Lake Enterprises
c/o Mr. Kenneth Leasure
Professional Building
Jefferson Avenue
Endicott, New York 13760

f. Purpose: Recreation.

g. Design and Construction History: The dam was designed by R. J. Martin, Consulting Engineer, with the assistance of Empire Soils Investigation, Inc. A permit for construction was issued by PennDER on 16 May 1974. An inspection by PennDER on 21 November 1974 certified that the dam had been constructed in a satisfactory manner, with the exception that the downstream slope had been constructed steeper than the design of 2H:1V. The owners subsequently corrected this problem.

h. Normal Operating Procedure: The reservoir is normally maintained at the crest of the outlet works riser. Inflow which exceeds the capacity of the outlet works is stored until it flows over the spillway weir. A minimum flow of 37,500 gallons/day must be maintained at all times in the stream downstream of the dam, according to the permit issued for the dam.

1.3 Pertinent Data.

a. Drainage Area (square miles)

| | |
|---------------------------|------|
| From files: | 0.39 |
| Computed for this report: | 0.39 |
| Use: | 0.39 |

b. Discharge at Damsite (cubic feet per second)

| | |
|---|---------|
| Maximum known flood | unknown |
| Outlet works with maximum pool (El. 1587.6) | 80 |
| Spillway with maximum pool (El. 1587.6) | 750 |

c. Elevations (feet above mean sea level)

| | |
|-----------------------|--------|
| Top of Dam | 1587.6 |
| Normal pool | 1580.0 |
| Spillway Crest | 1583.0 |
| Outlet Works | |
| Upstream invert | 1554.0 |
| Crest of Outlet Riser | 1580.0 |
| Downstream invert | 1552.0 |
| Streambed at toe | 1550.4 |

d. Reservoir Length (Feet)

| | |
|-----------------------------|------|
| Normal pool (El. 1580.0) | 2000 |
| Spillway crest (El. 1583.0) | 2200 |
| Maximum pool (El. 1587.6) | 2400 |

e. Storage (acre-feet)

| | |
|-----------------------------|-----|
| Normal pool (El. 1580.0) | 159 |
| Spillway crest (El. 1583.0) | 232 |
| Maximum pool (El. 1587.6) | 355 |

f. Reservoir Surface (acres)

| | |
|-----------------------------|----|
| Normal pool (El. 1580.0) | 24 |
| Spillway crest (El. 1583.0) | 25 |
| Maximum pool (El. 1587.6) | 28 |

g. Dam

Note: Refer to plates in Appendix E for plans and sections.

| | |
|--------------------|------------------------------------|
| <u>Type</u> | Earthfill |
| <u>Length</u> | 878 feet including spillway |
| <u>Top Width</u> | 12 feet |
| <u>Height</u> | 37.2 feet |
| <u>Side Slopes</u> | |
| Upstream | 1V:2H (existing) 1V:3H (design) |
| Downstream | 1V:2H |
| <u>Zoning</u> | Homogeneous |
| <u>Cutoff</u> | Trench 6 ft deep x 20 feet wide |
| <u>Grouting</u> | None |

h. Outlet Works

| | |
|----------------|--|
| <u>Type</u> | 24 inch RCP w/riser -122 linear feet 12 inch pond drain -51 linear feet |
| <u>Closure</u> | Sluice gate on 12 inch pond drain |

i. Spillway

| | |
|-------------------------|---|
| <u>Type</u> Trapezoidal | Broad-crested weir |
| <u>Location</u> | Left abutment |
| <u>Length</u> | Bottom Width - 20 feet Top Width - 44 feet |

| | |
|---------------------------|------------------------|
| <u>Crest Elevation</u> | 1583.0 |
| <u>Freeboard</u> | 4.6 feet |
| <u>Approach Channel</u> | Grass lined channel |
| <u>Downstream Channel</u> | Grass lined channel |

SECTION 2
ENGINEERING DATA

2.1 Design

The available data for Longford Lake Dam consist of files provided by PennDER. Information available includes a permit application report with a general description of the proposed design, construction progress reports, various related correspondence and specifications dated November 1973. Detailed design drawings dated March 1974 are also available, and provided in Appendix E.

2.2 Construction

Data available for this dam indicates that it was completed in November 1974 essentially in accordance with the approved plans and specifications. There was a question as to the stability of the downstream slope for the completed dam; however, this was resolved by placement of additional fill to provide a flatter slope in the spring of 1975.

2.3 Operation

No formal records of operation or maintenance are known to exist.

The most recent PennDER inspection indicated that the dam was in satisfactory condition.

2.4 Evaluation

a. Availability. All available written information was contained in the permit files provided by PennDER, and on the design drawings provided by the consulting engineer (ALE).

b. Adequacy. The available data, including that collected during the recent detailed visual inspection, are considered to be adequate to make a reasonable assessment of the dam.

SECTION 3

VISUAL INSPECTION

3.1 Observations

a. General. The overall appearance and general condition of Longford Lake Dam is good. No conditions were observed that would cause concern for the safety of this facility. The visual inspection checklist and field sketch are provided in Appendix A. Photographs taken during the inspection are reproduced in Appendix C.

On the day of the inspection, the reservoir pool was at normal pool level. The owner's representative was interviewed during the inspection.

b. Embankment. The horizontal alignment of the 12-foot wide crest is good. A profile taken along the dam centerline indicates that crest at the center of the dam is a minimum of 2.6 feet higher than at the abutments. The low point of the crest occurs approximately 60 feet to the right of the uncontrolled spillway. The upstream face of this earth embankment slopes at 1V:2H. This face is protected up to the crest with riprap which ranges in size from 8 inches to 36 inches. This stone is in good condition and the slope appears stable. One rodent burrow exists on this face near the right abutment. Three-foot high briars are growing on this slope; however, the growth is presently rather sparse. The downstream face slopes at 1V:2H except near the toe where the slope flattens to 1V:4.5H. This area varies in width from zero at the abutments to 30 feet at the maximum section. The downstream slope supports a good stand of grass and no erosion or sloughing are evident. A wet area, approximately 30 feet in width, exists near the right downstream toe. Water is flowing from this area at the rate of approximately 1 gallon per minute. The cause of this condition is unknown, although an informal ditch about one foot deep is evident just downstream of the toe of the dam between the wet area and the right abutment. A probable cause is local springs or the runoff from the ground surface which had partially thawed. The toe area itself is firm.

c. Appurtenant Structures. The outlet works for this facility consists of a single-stage reinforced concrete riser with covered top, a 24-inch diameter reinforced concrete conduit without closure and a reinforced concrete impact-type energy dissipater. In addition, a 12-inch diameter ductile iron pipe extends upstream of the riser to act as a pond drain. Flow through this pipe is controlled by a gate valve on the inside face of the riser. Since there is no access to the riser except by boat, only the exposed portion of the structure could be observed. The concrete and the trash racks appear to be in good condition. The control mechanism or operator for the pond drain gate is not visible. The discharge end of the conduit and the energy dissipater are also in good condition. The pipe was discharging water to a depth of about 2 inches. The discharge channel is apparently the original streambed. This channel is partially lined with rock and presents no obstructions to flow.

The spillway for this dam is an earth channel which was excavated in the left abutment of the dam. This grass-lined trapezoidal channel has a bottom width of 20 feet and 1V:2H side slopes. The spillway approach is a grass-lined channel. There are no obstructions to flow except for a small deposit of eroded material near the upstream end of the channel. This eroded material is being deposited by a natural drainage course which enters the left side of the spillway. Some erosion of the spillway side slope is occurring. The channel slopes slightly upward from the entrance to the control section which is located in line with the downstream side of the crest. No concrete sill or formal control structure exists at this point. The channel then slopes down and bends to the right. An earth dike separates the spillway from the dam both upstream and downstream of the crest. The channel ends well beyond the toe of the dam. Flows from this channel must flow overland for about 200 feet before joining the existing streambed. No conditions are evident that would prevent the spillway from operating as designed.

d. Reservoir Area. The reservoir slopes are wooded and moderately sloping. The slopes do not exhibit any apparent signs of instability. A few vacation homes are located near the lake.

e. Downstream Channel. The initial 4,000 feet of this unnamed stream flows through a confined wooded area with moderate side slopes and a flat channel slope. The next 6,500 feet of channel is very confined by steep side slopes and minimal floodplain area. The channel slope in this wooded reach is also steep. Approximately 2 miles downstream of the dam, Pennsylvania Route 267 crosses over the channel via a small concrete bridge. One house, with a first floor elevation six feet above the streambed, is located immediately downstream of this bridge and adjacent to the stream. About 900 feet further downstream, this stream joins Choconut Creek and flows north. The side and channel slopes through this meadow area are mild. Approximately 1,200 feet downstream of the confluence with Choconut Creek a trailer park is located in the floodplain. The ground on which these trailers are parked is about 8 feet above the streambed. Eight trailers are presently in this park. The location of these trailers and the house just upstream create the potential for the loss of more than a few lives and property damage should Longford Lake Dam fail. These conditions warrant a high hazard classification for this dam.

f. Evaluation. The facility is well maintained; however, the operational condition of the pond drain valve should be determined. Although the wet area near the toe causes no concern for the safety of the dam at this time, this condition should be monitored for significant changes.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure. The lake is normally maintained at the crest of the concrete riser, elevation 1580.0. Inflow in excess of the capacity of the outlet works is stored until reaching the spillway crest, elevation 1583.0. Inflow would then be discharged through the spillway.

4.2 Maintenance of Dam. The condition of the dam as observed by the inspection team is good. Basic maintenance has been performed and the facility should operate as designed during a flood event. No formal maintenance manual exists.

4.3 Maintenance of Operating Facilities. The outlet works consist of a concrete riser which acts as a drop inlet weir. The structure appears to operate satisfactory. Included in the structure is a gate valve which when operated would drawdown the lake. No formal maintenance manual exists.

4.4 Warning System. No formal warning system exists.

4.5 Evaluation. Maintenance of the facility appears to be adequate. Formal manuals of maintenance and operation are recommended to ensure all needed maintenance is identified and performed regularly. In addition, a formal warning system for the protection of downstream inhabitants should be developed. Included in the plan should be provision for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

SECTION 5

HYDRAULIC/HYDROLOGIC EVALUATION

5.1 Design Data. No formal design drawings were found in the PennDER files. However, detailed design drawings were obtained from the consulting engineer. Design reports and a few calculations were found and reviewed as part of this study.

5.2 Experience Data. Records of reservoir levels and/or spillway discharges are not available. The dam and appurtenant structures were completed in 1974. No records of past performance are available.

5.3 Visual Observations. On the date of the inspection, no problems were observed that would prevent the facility from operating as designed during a flood event. The embankment and appurtenant structures appeared well maintained. See field sketch in Appendix A and photographs in Appendix C for physical layout of the facility.

5.4 Method of Analysis. The facility has been analyzed in accordance with procedures and guidelines established by the U.S. Army Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. This analysis has been performed using a modified version of the HEC-1 program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. Capabilities of the program are briefly outlined in the preface contained in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the SDF for Longford Lake Dam ranges between the 1/2 Probable Maximum Flood (PMF) and the full PMF. This classification is based on the relative size of the dam (small), and the potential hazard of failure to downstream development (high). Due to the height (37.2 feet), and the degree of downstream hazard, the SDF selected was the full PMF.

b. Results of Analysis. Longford Lake Dam was evaluated under near normal operating conditions. The starting lake level was set at elevation 1580.0, the crest of the concrete riser. The 24-inch conduit was assumed blocked. The following values were calculated and can be found in Appendix D of this report.

| | |
|---------------------------------|----------|
| Spillway Capacity at Top of Dam | 750 CFS |
| SDF (full PMF) Peak Inflow | 1350 CFS |

The overtopping analysis (using HEC-1DB) indicated that the discharge/storage capacity of Longford Lake Dam can pass 88% of the PMF prior to overtopping the embankment. Since the facility can pass more than 50% of the PMF, no breach analysis is required.

5.6 Spillway Adequacy. Under existing conditions, Longford Lake Dam cannot accommodate the SDF (full PMF), therefore, the spillway is rated as inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) Embankment. Longford Lake Dam is an earth embankment that is in good condition. The dam has a 12 foot wide crest, an upstream slope of 2H:1V and a downstream slope of 2H:1V except near the toe where the embankment slope changes to a 4.5H:1V slope. This berm varies in width from zero at the abutments to approximately 30 feet at the maximum section. The dam was essentially completed in 1974 and appears to be reasonably well maintained. The upstream slope is riprapped with 8 to 36 inch stone. An area approximately 30 feet wide adjacent to the right downstream toe is slightly wet. Water was observed to be flowing at a rate of approximately 1 gpm from this area; however, it could not be determined if the water was from melting ice and snow or from a possible spring in this area. The toe area itself was firm.

(2) Appurtenant Structures. The dam contains a concrete riser which acts as the outlet works and a spillway. The top of the riser is approximately 8 foot by 12 foot. At the outlet end, a 24 inch RCP discharges into a concrete structure with a baffle. The water then flows into a partially riprapped channel. The entire outlet structure appears to be in good condition. At the left abutment is an emergency spillway cut into natural ground. The bottom width is 20 feet, and the side slopes are 2H:1V. The spillway channel is covered with a good growth of grass. No signs of instability were observed. A drainage ditch enters the left channel wall about 50 feet from the lake. This ditch should be riprapped at the spillway channel to prevent erosion.

b. Design and Construction Data.

(1) Embankment. The design data consist of boring and test pit information and technical specifications. The embankment was designed to be a homogeneous earthfill structure with a crest width of 20 feet, an upstream slope of 3H:1V and a downstream slope of 2H:1V with a berm at the toe of approximately 8.5H:1V.

A cutoff trench 6 feet deep and 20 feet wide was designed for the structure. The trench centerline was offset upstream of the dam centerline by a distance equal to the maximum height of water, approximately 26 feet. A drainage blanket, 3 feet thick, with a toe drain and collector pipe was recommended by the design engineer firm. However, during construction, a request was made to reduce the thickness of the drainage blanket to 2 feet, which was approved. No reference was made to the collector pipe being installed and no evidence was observed during the inspection to indicate that the collector pipe had been installed.

(2) Appurtenant Structures. The design data is listed in paragraph 6.1b(1). The outlet works was a 24 inch concrete pipe. A 12 inch ductile iron pond drain is controlled by a valve located in the outlet riser. The 24 inch discharge line and pond drain line were to be placed on a concrete cradle and have seepage cut-off collars. The spillway in the left abutment design was to have a bottom width of 25 feet and side slopes of 2H:1V.

c. Operating Records. None.

d. Post Construction Changes. None.

e. Seismic Stability. The dam is located in Seismic Zone 1. On the basis of visual observations the dam is considered to be statically stable. Therefore, the seismic stability is considered adequate.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment.

a. Safety. The visual inspection and review of available design and construction data indicate that Longford Lake Dam is in good condition. In accordance with the guidance provided, the spillway design flood (SDF) ranges between 1/2 the PMF and the full PMF. Based on the size and extent of downstream hazard for the dam, the SDF selected for this facility was the PMF.

The hydrologic and hydraulic computations indicate that the combination of reservoir storage and spillway discharge capacity will pass 88% of the PMF prior to overtopping the embankment. Therefore, in accordance with the criteria outlined and evaluated in Section 5.5, the spillway for Longford Lake Dam is considered to be inadequate.

b. Adequacy of Information. The design and construction data contained in PennDER files, in conjunction with data collected during the recent visual inspection, are considered to be adequate for making a reasonable assessment of this dam.

c. Urgency. The recommendations presented below should be implemented without delay.

d. Necessity for Additional Studies. The results of this inspection indicate no need for additional studies at this time.

7.2 Recommendations.

1. The operational condition of the pond drain should be determined.

2. The wet areas near the embankment toe should be monitored, and appropriate remedial measures taken should any significant changes in turbidity or flow rate be observed.

3. The natural drainage ditch at the left abutment should be riprapped to protect against erosion of the spillway channel.

4. The rodent hole in the embankment should be backfilled.

5. A formal surveillance and downstream emergency warning system should be developed for use during periods of heavy or prolonged precipitation.

6. An operation and maintenance manual or plan should be prepared for use as a guide in the operation and maintenance of the dam during normal and emergency conditions.

7. A schedule of regular inspection by a qualified engineer should be developed.

APPENDIX A
CHECKLIST - VISUAL INSPECTION

APPENDIX A

Check List
Visual Inspection
Phase 1

Name Dam Longford Lake, P.R. I.D. No. 58-127 County Susquehanna State Pennsylvania
Date(s) Inspection 24 Mar 81 Weather Ptly Cloudy Temperature 40's
Pool Elevation at Time of Inspection 1580.0 M.S.L. Tailwater at Time of Inspection 1551.0 M.S.L.

Inspection Personnel:

| | | |
|-----------------------------|--------------------------|---|
| <u>J. Bianco, C.O.E.</u> | <u>E. Hecker, C.O.E.</u> | <u>Mrs. J. F. McIlley, Rep of Owner</u> |
| <u>B. Cortright, C.O.E.</u> | | |
| <u>J. Evans, C.O.E.</u> | | |
| | <u>B. Cortright</u> | <u>Recorder</u> |

EMBANKMENT

| <u>VISUAL EXAMINATION OF</u> | <u>OBSERVATIONS</u> |
|--|---|
| <u>Noticeable Seepage</u> | Ditch with minimal flow; 10-20 feet beyond toe (right of outlet). |
| <u>Junction of Embankment with: Abutments Spillway</u> | Embankment with right abutment - Tire ruts but no erosion. |
| <u>Surface Cracks</u> | None. |
| <u>Crest Alignment</u> | Good. |
| <u>Unusual Movement or Cracking at or beyond the Toe</u> | None. |

EMBANKMENT

| VISUAL EXAMINATION OF | OBSERVATIONS |
|--------------------------------|---|
| Sloughing or Erosion: | None |
| Embankment Crest/Slopes | |
| Abutment Slopes | |
| Riprap | Average size 1.5 feet; uneven in place but no failures. |
| Instrumentation | None. |
| Staff Gage | None. |
| Miscellaneous | Sparse growth of briars on upstream slope (2-3 feet high). |

OUTLET WORKS

| VISUAL EXAMINATION OF | | OBSERVATIONS |
|-----------------------|--|---|
| Intake Structure | SCS type drop inlet | - good condition. |
| Outlet Conduit | Only discharge end visible; | 24-inch diameter iron pipe in good condition. |
| Gates or Valves | Valve on pond drain only; | located within intake structure not operated during inspection. |
| Outlet Structure | Concrete impact type energy dissipater | in good condition. |
| Outlet Channel | Rock lined for first 75 feet; | good condition and no obstructions. |

SPILLWAY

VISUAL EXAMINATION OF
Approach Channel 1

OBSERVATIONS

Grass-lined. Cut in natural ground. Slopes up toward control section.

Weir and Walls None - Control section is level grass lined area at the centerline of dam.

Discharge Channel 1

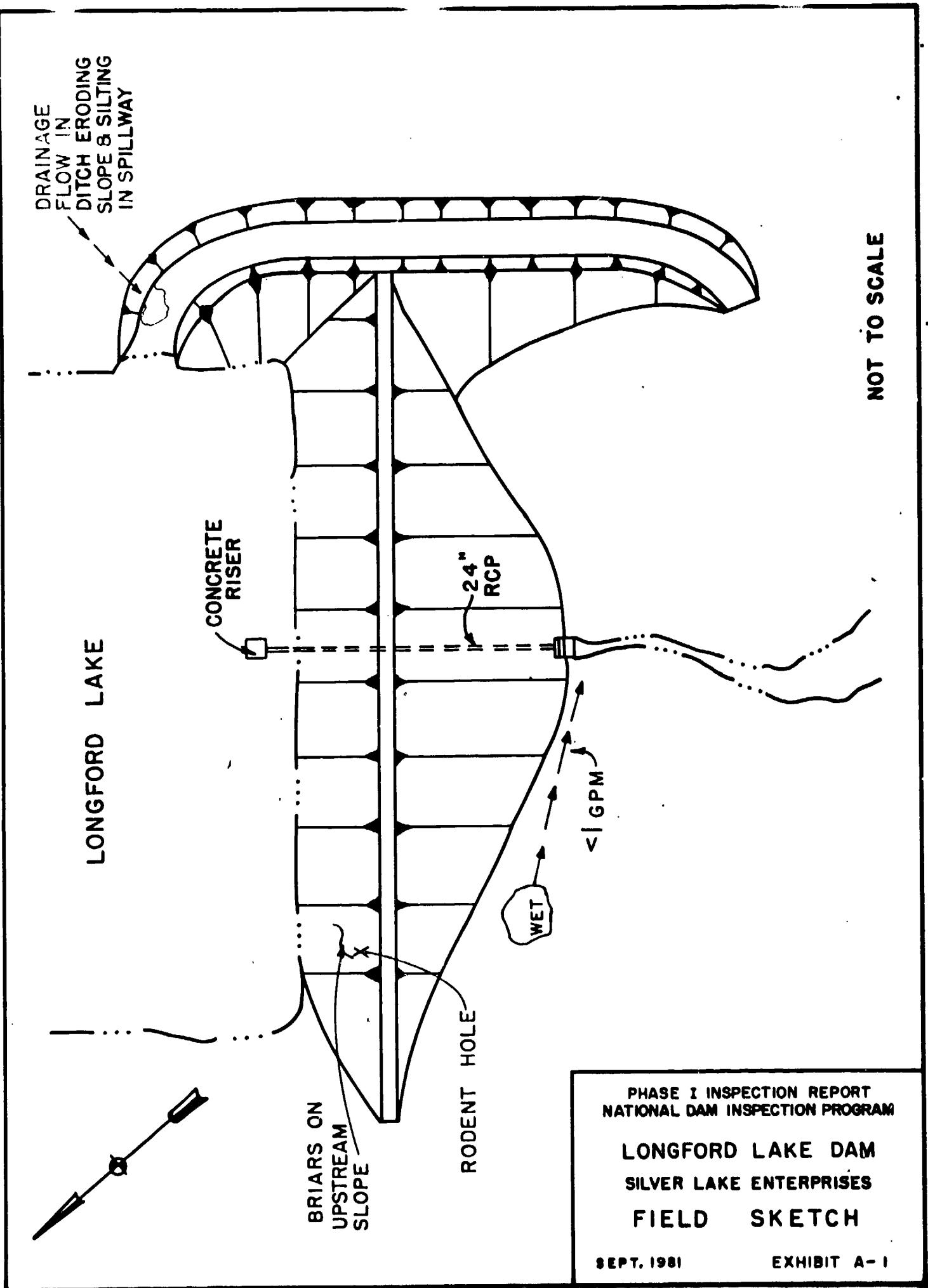
Grass-lined earth cut; no erosion.

RESERVOIR

| VISUAL EXAMINATION OF | | OBSERVATIONS |
|-----------------------|----------------|---|
| Slopes | | Generally wooded with moderate to steep slopes. Appeal stable. |
| Sedimentation | None observed. | |

DOWNTSTREAM CHANNEL

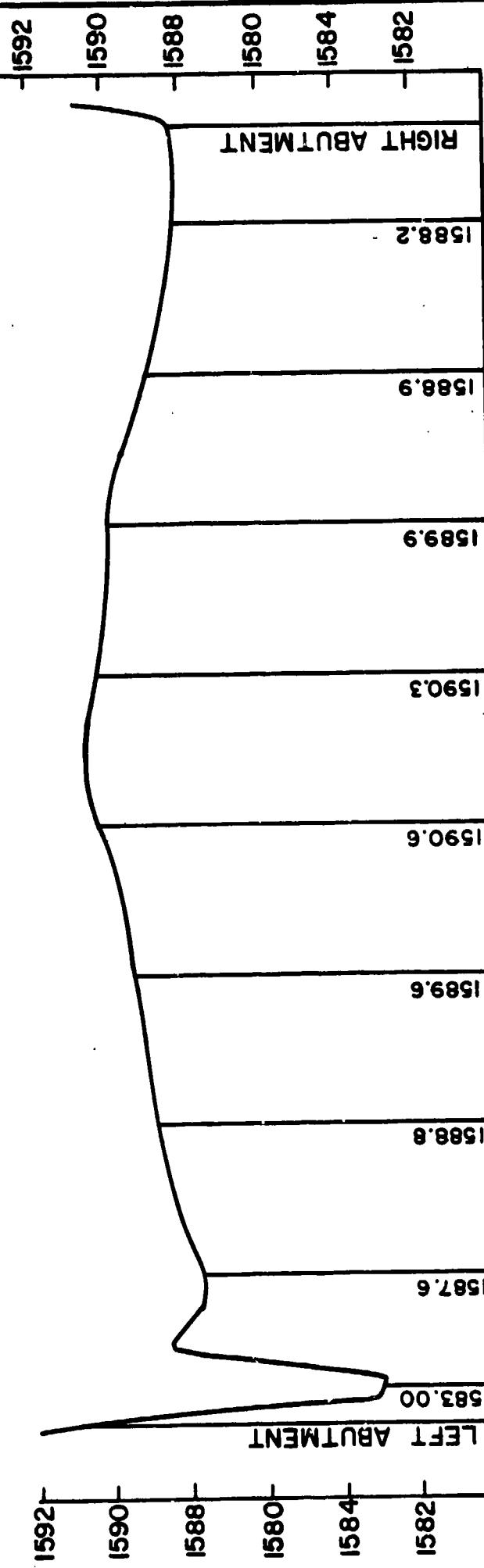
| VISUAL EXAMINATION OF | | OBSERVATIONS |
|--|-----------------------------------|---|
| <u>Condition:</u> Obstruction, etc. | | Confined through woods. PA Route 267 bridge is 2.0 miles downstream. Joins Chocomut Creek 0.2 mile beyond bridge. |
| <u>Slopes</u> | Moderate with wooded side-slopes. | One house (first floor 6 feet above streambed) immediately downstream PA Route 267 (2.0 miles downstream of dam). At least 9 mobile homes in floodplain of Chocomut Creek 2.5 miles downstream of dam. |



TOP OF DAM - PROFILE
SCALE - HORZ 1 IN = 100 FT
SCALE - VERT 1 IN = 4 FT

DISTANCE IN FEET

9+00 8+00 7+00 6+00 5+00 4+00 3+00 2+00 1+00 0+00



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LONGFORD LAKE DAM
SILVER LAKE ENTERPRISES
PROFILE

SEPT, 1981

EXHIBIT A-2

APPENDIX B
CHECKLIST - ENGINEERING DATA

APPENDIX B

Check List
Engineering Data
Design, Construction, Operation
Phase 1

NDI ID No. PA 00898

Name of Dam: Longford Lake Dam

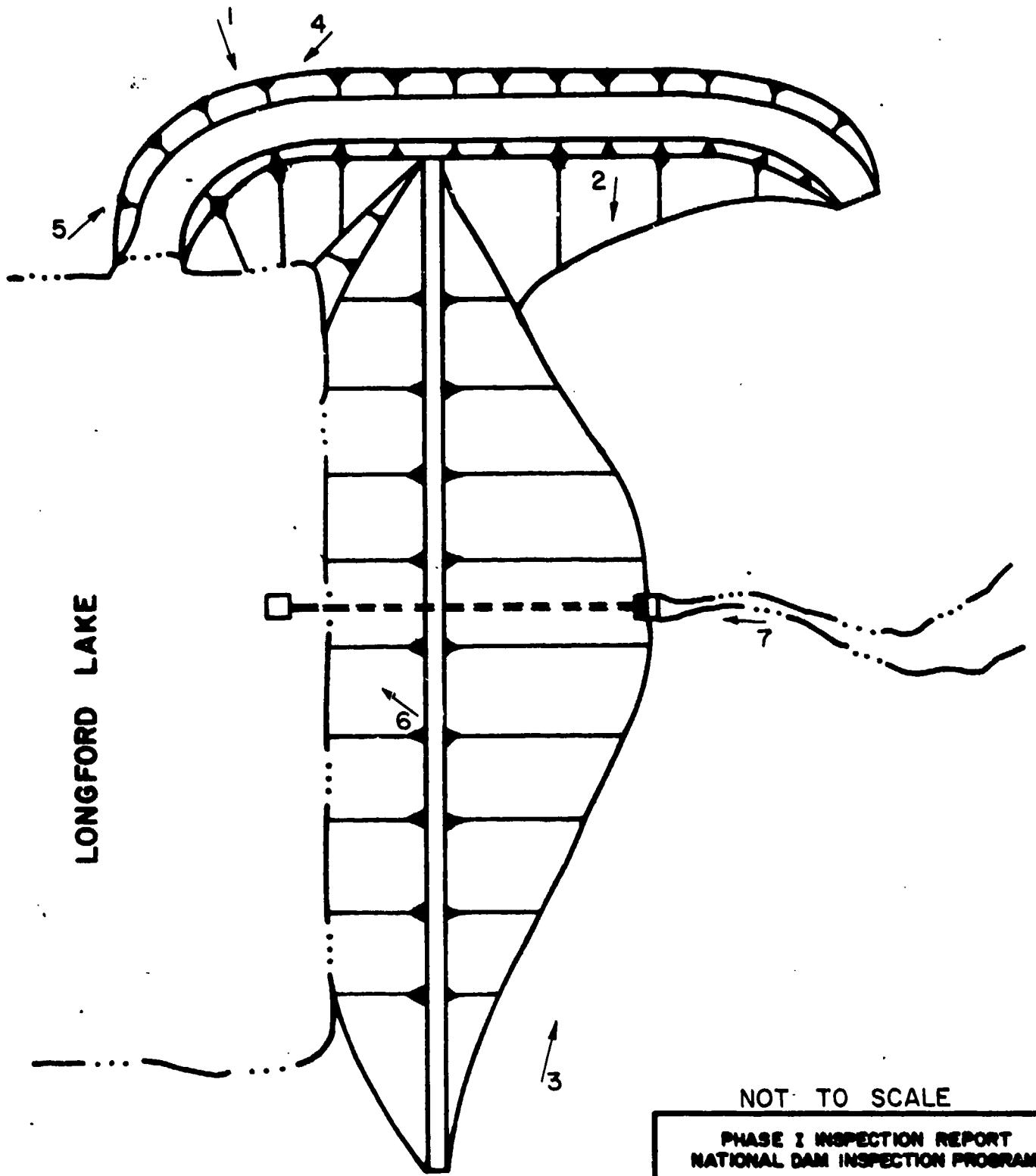
| ITEM | REMARKS |
|----------------------------|---|
| As-built Drawings | None. |
| Regional Vicinity Map | U.S.G.S. Quadrangle Sheet Entitled Laurel Lake, Pa., (7.5 Minute Series) See Appendix E, Plate E-II |
| Construction History | Designed by R. J. Martin, Consulting Engineer Permit for Construction issued by PennDER - 16 May 1974 PennDER inspection on 21 November 1974 certified that dam was complete. |
| Typical Sections of Dam | See Appendix A, Exhibit A-2 for profile, and design drawings provided in Appendix E. |
| Outlets - Plan | Specifications dated November 1973 |
| Details | None available. |
| Constraints | |
| Discharge Ratings | |
| Rainfall/Reservoir Records | |

| REMARKS | |
|--|---|
| ITEM | |
| Design Reports | 1. PennDER permit application report 2. Specifications dated November 1973 |
| Geology Reports | None. |
| Design Computations Hydrology & Hydraulics Dam Stability Seepage Studies | None. |
| Materials Investigations Boring Records Laboratory Field | 1. Boring and test pit data 2. Specifications dated November 1973 |
| Post-Construction Surveys of Dam | None. |
| Borrow Sources | None. |

| ITEM | REMARKS |
|--|----------------|
| <u>Monitoring Systems</u> | None. |
| <u>Modifications</u> | None reported. |
| <u>High Pool Records</u> | None. |
| <u>Post-Construction Engineering Studies and Reports</u> | None. |
| <u>Prior Accidents or Failure of Dam Description Reports</u> | N/A |
| <u>Maintenance Operation Records</u> | None. |

| ITEM | REMARKS |
|----------------------------|---|
| <u>Spillway Plan</u> | None. |
| <u>Sections</u> | |
| <u>Details</u> | |
| <u>Operating Equipment</u> | |
| <u>Plans & Details</u> | N/A |
| <u>Specifications</u> | Specifications dated November 1973. |
| <u>Miscellaneous</u> | PennDEP inspection reports and related correspondence |

APPENDIX C
PHOTOGRAPHS



LOCATION AND ORIENTATION OF CAMERA
3 PHOTOGRAPH IDENTIFICATION NUMBER

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LONGFORD LAKE DAM
SILVER LAKE ENTERPRISES
PHOTOGRAPH LOCATION
PLAN

LONGFORD LAKE DAM



1. Upstream face, crest and right abutment.
Top of intake structure visible in lake.



2. Downstream face.

LONGFORD LAKE DAM



3. Wet area at toe near right abutment.



4. Spillway approach.

LONGFORD LAKE DAM

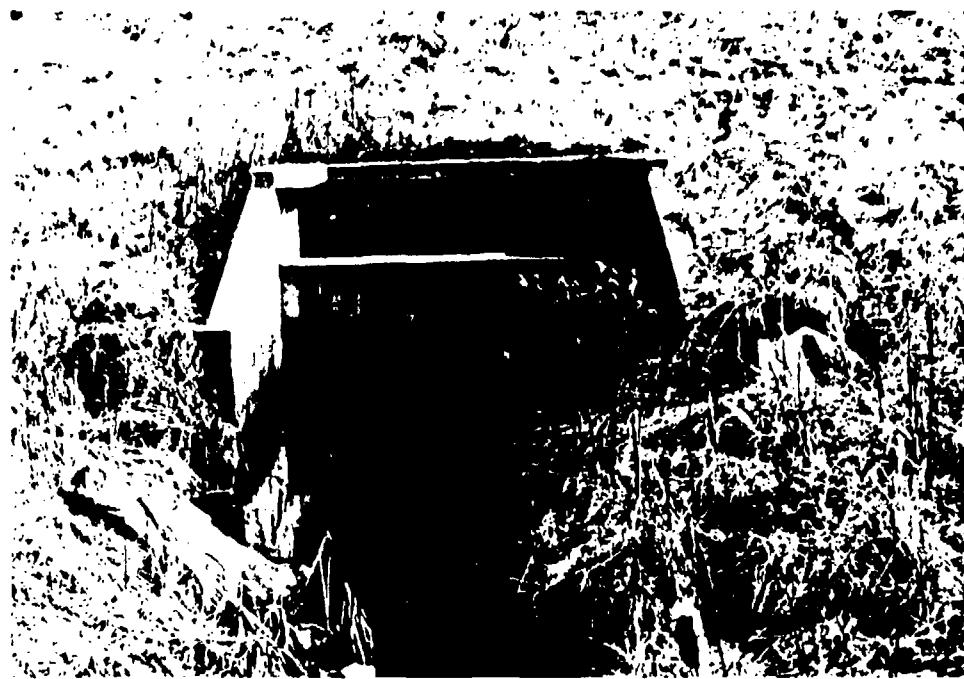


5. Upstream portion spillway channel.



6. Intake structure for outlet works.

LONGFORD LAKE DAM



7. Impact-type energy dissipator at discharge end of conduit.



8. First downstream hazard (2 miles downstream). Pennsylvania Route 267 bridge is in center of picture.

LONGFORD LAKE DAM



9. Trailer park which constitutes second downstream hazard.

APPENDIX D
HYDROLOGY AND HYDRAULICS

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

- a. Development of an inflow hydrograph(s) to the reservoir.
- b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequence resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

- a. Development of an inflow hydrograph(s) to the reservoir.
- b. Routing of the inflow hydrograph(s) through the reservoir.
- c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.
- d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevations of failure hydrographs for each location.

HYDROLOGY & HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: LONGFORD LAKE DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 INCHES/24 HOURS (1)

SUSQUEHANNA River BASIN

| STATION | 1 | 2 | 3 |
|--|----------------------|---|---|
| STATION DESCRIPTION | LONGFORD LAKE DAM | | |
| DRAINAGE AREA (SQUARE MILES) | 0.39 | | |
| CUMULATIVE DRAINAGE AREA (SQUARE MILES) | 0.39 | | |
| ADJUSTMENT OF PMF FOR (1) DRAINAGE AREA LOCATION (%) ADJUSTED VALUES | 97% | | |
| 6 Hours | 113.5 | | |
| 12 Hours | 123.2 | | |
| 24 Hours | 131.9 | | |
| 48 Hours | 138.7 | | |
| 72 Hours | 140.7 | | |
| SNYDER HYDROGRAPH PARAMETERS | | | |
| Zone (2) | 11A | | |
| C_p (3) | 0.62 | | |
| C_t (3) | 1.50 | | |
| L^t (MILES) (4) | 0.985 | | |
| L_{ca} (MILES) (4) | 0.32 | | |
| $t_p = C_t (L \cdot L_{ca}) 0.3$ (HOURS) | .06 | | |
| SPILLWAY DATA | | | |
| CREST LENGTH (FEET) | 20 | | |
| FREEBOARD (FEET) | 4.6 | | |

(1) HYDROMETEOROLOGICAL REPORT - 40, U. S. Army Corps of Engineers, 1955.

(2) Hydrologic zone defined by Corps of Engineers, Baltimore District, For Determination of Snyder Coefficients (C_p and C_t).

(3) Snyder Coefficients

(4) L = Length of longest watercourse from dam to basin divide.

L_{ca} = Length of longest watercourse from dam to point opposite basin centroid.

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAM SHEET 1 OF 8 SHEETSCOMPUTED BY JRB CHECKED BY _____ DATE 5-18-81DAM CLASSIFICATION

SIZE OF DAM - SMALL

HAZARD - HIGH

REQUIRED SAF - $\frac{1}{2}$ PMF TO FULL PMFDAM STATISTICS

HEIGHT OF DAM - 37.2 FEET

STORAGE AT NORMAL POOL - 159 AC-FT

STORAGE AT SPILLWAY CREST - 232 AC-FT

STORAGE AT TOP OF DAM - 355 AC-FT

DRAINAGE AREA ABOVE DAMSITE - 0.39 mi²ELEVATIONS

TOP OF DAM LOW POINT (FIELD) - 1587.6

NORMAL POOL - 1580.0

SPILLWAY CREST - 1583.0

STREAMBED AT TOE - 1550.4

HYDROGRAPH PARAMETERS

RIVER BASIN - SUSQUEHANNA RIVER BASIN

ZONE - 11A

SYNDER COEFFICIENT -

$$C_p = 0.62$$

$$C_L = 1.50$$

MEASURED PARAMETERS* $L = \text{LENGTH OF LONGEST WATERCOURSE}$ $L = 5200 \text{ feet}$ 0.985 miles $L_a = \text{LENGTH OF LONGEST WATERCOURSE TO CENTROID}$ $L_a = 1700 \text{ feet}$ 0.32 miles
OF BASIN* FROM U.S.G.S. QUAD SHEET ENTITLED LAUREL LAKE, PA.-N.Y.
7 1/2 MINUTE SERIES, SCALE 1:24000

SUBJECT DAM SAFETY ANALYSIS

PAGE _____

COMPUTATIONS LONGFORD LAKE DAMSHEET 2 OF 2 SHEETSCOMPUTED BY JPB

CHECKED BY _____

DATE 5-19-81

NOTE: ELEVATIONS ARE REFERENCED TO TOPOGRAPHIC DATA.
 NORMAL POOL WAS ASSUMED TO PRINCIPAL SPILLWAY
 AT ELEVATION 1580.0. ALL ELEVATIONS WERE REFERENCED
 TO THIS VALUE.

t_p = SNYDER BASIN LASTIME, HOURS

$$t_p = C_p (L L_{ct})^{0.3} ; t_p = 1.50 (0.985(0.8))^{0.3} = 1.06 \text{ hours}$$

RESERVOIR CAPACITY:

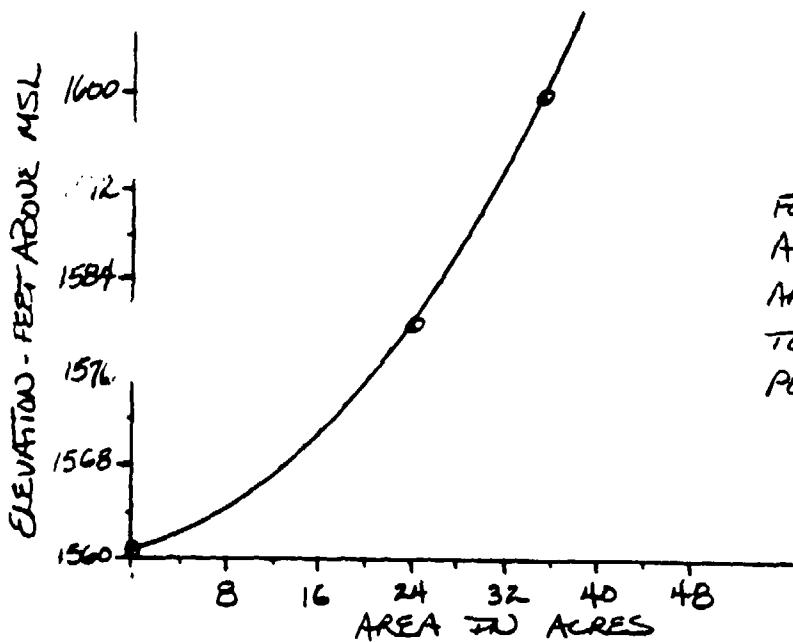
SURFACE AREA AT PRINCIPAL SPILLWAY - 24 ACRES (FROM DER)
 SURFACE AREA AT ELEVATION 1600 - 35 ACRES

ASSUME CONICAL METHOD APPLIES TO FIND LOW POINT
 IN POOL, BELOW SPILLWAY CREST (PRINCIPAL) - EL 1580.0

VOLUME AT PRINCIPAL SPILLWAY CREST - 159 AC-FT
 (FROM DESIGN DATA IN SNYDER FILES)

$$V = \frac{1}{3} \pi A H ; H = \frac{3V}{\pi A} = \frac{3(159 \text{ AC-FT})}{\pi 24 \text{ AC}} = 19.88 \text{ FEET}$$

∴ ZERO STORAGE AT ELEVATION 1560.12



FOR FLOOD ROUTING PURPOSES,
 ASSUME THE AVERAGE END
 AREA METHOD IS SUITABLE
 TO ELEVATIONS ABOVE STARTING
 POOL.

$$\therefore \Delta V = \left(\frac{A_1 + A_2}{2} \right) \Delta H$$

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAM SHEET 3 OF 3 SHEETSCOMPUTED BY JPB CHECKED BY _____ DATE 5-19-81ELEVATION - STORAGE TABLE:

| ELEVATION (MSL) | AREA (ACRES) | Δt (ft) | $\Delta V = \frac{(A_1 + A_2)}{2} \Delta h$ (AC-FT) | CUMULATIVE VOLUME (AC-FT) |
|---|-----------------|------------|--|---------------------------------|
| 1560.2 | 0 | - | - | 0 |
| 1580.0 ^{PERIODIC SAMPLING} | 24 | - | 159.0 | 159.0 |
| 1583.0 ^{ENR SAMPLING} | 25 | 3.0 | 79.5 | 232.5 |
| 1584.0 | 26 | 1.0 | 25.5 | 258.0 |
| 1586.0 | 27 | 2.0 | 53.0 | 311.0 |
| 1587.6 ^{TOP OF DAM} | 28 | 1.6 | 44.0 | 355.0 |
| 1588.0 | 29 | 0.4 | 11.4 | 366.4 |
| 1590.0 | 30 | 2.0 | 59.0 | 425.4 |
| 1595.0 | 32 | 5.0 | 155.0 | 580.4 |
| 1600.0 | 35 | 5.0 | 167.5 | 747.9 |

NOTE: DRAINAGE AREA ABOVE DAM IS 0.39 mi²

| ELEVATION (MSL) | STORAGE (AC-FT) |
|--------------------|--------------------|
| 1560.2 | 0 |
| 1580.0 | 159 |
| 1583.0 | 232 |
| 1584.0 | 258 |
| 1586.0 | 311 |
| 1587.6 (TOD)* | 355 |
| 1588.0 | 366 |
| 1590.0 | 425 |
| 1595.0 | 580 |
| 1600.0 | 748 |

THIS DATA TO
BE INPUT ON
\$E AND \$S
CARDS.

* TOD - TOP OF DAM (LOW POINT FROM FIELD INSPECTION)

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAM SHEET 4 OF 5 SHEETSCOMPUTED BY JPB CHECKED BY _____ DATE 5-19-81PMP CALCULATIONS:

- APPROXIMATE RAINFALL INDEX - 22.2 INCHES
(CORRESPONDS TO A DURATION OF 24 HOURS AND A DRAINAGE AREA OF 200 mi²)
- SUSQUEHANNA RIVER BASIN
- DEPTH-AREA-DURATION HYDROMET 40 VALUES
GEOGRAPHIC AREA ADJUSTMENT MADE BY HYDROMET 40
FIGURE 1 IS 97 %.
- ASSUME VALUES CORRESPONDING TO A 10 mi² AREA MAY BE USED ON THIS 0.39 mi² AREA

| <u>DURATION(HRS)</u> | <u>PERCENT OF INDEX RAINFALL</u> |
|----------------------|----------------------------------|
| 6 | 117 |
| 12 | 127 |
| 24 | 136 |
| 48 | 143 |
| 72 | 145 |
| | x (0.97) = |
| | 113.5 |
| | 123.2 |
| | 131.9 |
| | 138.7 |
| | 140.7 |

NOTE: HOP BROOK FACTOR IS INTERNALLY COMPUTED BY THE HELI PROGRAM. FOR A DRAINAGE AREA LESS THAN 10 mi², THE ADJUSTMENT FACTOR = 0.80. THIS ADJUSTMENT IS FOR BASIN SHAPE AND THE LESS LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALL BASIN.

SDF: BASED ON THE SMALL STORAGE AND LARGE HEIGHT, THE SAF SELECTED FOR A HIGH HAZARD WOULD RANGE BETWEEN THE 1/2 AND FULL PMF. THE SDF SELECTED FOR THIS FACILITY WOULD BE THE FULL PMF.

THEREFORE, SDF = FULL PMF

BALTIMORE DISTRICT, CORPS OF ENGINEERS

SUBJECT DAM SAFETY ANALYSIS

PAGE _____

COMPUTATIONS LONGFORD LAKE DAM

SHEET 5 OF 5 SHEETS

COMPUTED BY JMB

CHECKED BY _____

DATE 5-19-81

EMERGENCY SPILLWAY CAPACITY:

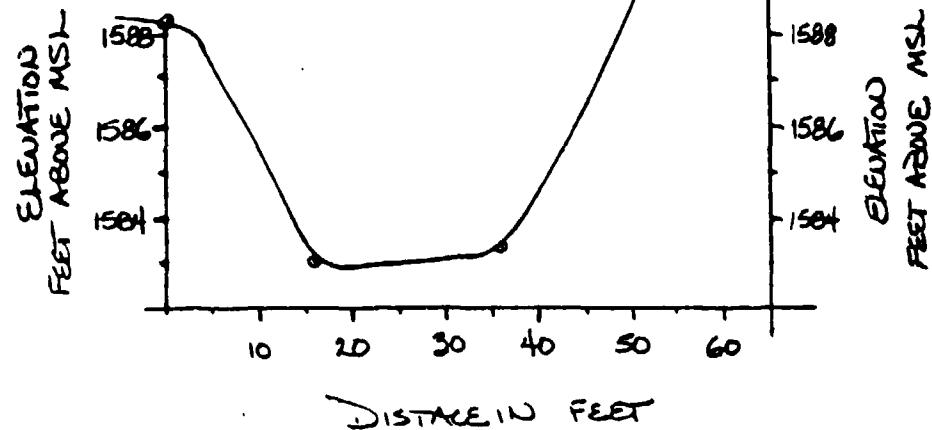
THE SPILLWAY IS LOCATED NEAR THE LEFT ABUTMENT, SEE FIELD SKETCH IN APPENDIX A, EXHIBIT 1, AND PHOTOGRAPHS IN APPENDIX C.

SPILLWAY DATA:

| | | |
|------------------------|---------------------------------------|-----------|
| TYPE - | TRAPEZOIDAL SHAPED BROAD-CRESTED WEIR | |
| LENGTH - | BOTTOM WIDTH - | 20 FEET |
| | TOP WIDTH | - 44 FEET |
| CREST ELEVATION - | 1583.0 MSL | |
| LOW POINT TOP OF DAM - | 1587.6 MSL | |
| SPILLWAY FREEBOARD - | 4.6 FEET | |
| C VALUES | SPILLWAY | - 2.85 |
| | EMBANKMENT | - 2.85 |

SPILLWAY SKETCH:

SKETCH IS IN FLAT SECTION OF SPILLWAY CREST.



BALTIMORE DISTRICT, CORPS OF ENGINEERS

SUBJECT JAM SAFETY ANALYSIS

PAGE _____

COMPUTATIONS LONGFORD LAKE DAMSHEET 6 OF 6 SHEETSCOMPUTED BY JPB

CHECKED BY _____

DATE 5-14-81SPILLWAY RATING CURVE:

THIS ANALYSIS ASSUMES THAT THE SPILLWAY BEHAVES AS A BROAD-CRESTED WEIR. DISCHARGE CAN BE ESTIMATED BY:

$$Q = C L_T H_w^{3/2}$$

WHERE:

Q = DISCHARGE THRU SPILLWAY

L_T = TOP WIDTH THROUGH SPILLWAYH_w = WEIGHTED HEAD, IN FEET, AVERAGE FLOW AREA

C = COEFFICIENT DISCHARGE

C = 2.85 FROM VARNELL & NAGLER FOR BROAD-CRESTED WEIR

TOP WIDTH OF SPILLWAYVS. RESERVOIR ELEVATION:

| RESERVOIR ELEVATION (MSL) | WIDTH (ft) |
|---------------------------|------------|
| 1583.0 | 29 |
| 1584.0 | 24 |
| 1585.0 | 30 |
| 1586.0 | 35 |
| 1587.0 | 41 |
| 1587.6 | 44 |
| 1588.0 | 46 |
| 1590.0 | 51 |
| 1600.0 | 51 |

SUBJECT JAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAMSHEET 7 OF 8 SHEETSCOMPUTED BY JB

CHECKED BY _____

DATE 5-14-81

| RESERVOIR ELEVATION (MSL) | L ₁ (ft) | L ₂ (ft) | INCREMENTAL HEAD, H _i (ft) | INCREMENTAL | | TOTAL HEAD AREA, A _T (ft ²) | WEIGHTED HEAD, H _W (ft) | Q (CFS) |
|---------------------------|---------------------|---------------------|---------------------------------------|---|---|--|------------------------------------|---------|
| | | | | FRONT AREA, A _i (ft ²) | AREA, A _T (ft ²) | | | |
| 1583.0 | 20 | - | 0 | - | - | - | - | 0 |
| 1584.0 | 24 | 20 | 1.0 | 22.0 | 22.0 | 0.917 | 60.0 | ① |
| 1585.0 | 30 | 24 | 1.0 | 27.0 | 49.0 | 1.633 | 178.5 | ② |
| 1586.0 | 35 | 30 | 1.0 | 32.5 | 81.5 | 2.329 | 354.6 | ③ |
| 1587.0 | 41 | 35 | 1.0 | 38.0 | 119.5 | 2.9146 | 581.4 | 9 |
| 1587.6 (TOP) | 44 | 41 | 0.6 | 25.5 | 145.0 | 3.2954 | 750.2 | 9 |
| 1588.0 | 46 | 44 | 0.4 | 18.0 | 163.0 | 3.543 | 874.3 | 9 |
| 1589.0 | 51 | 46 | 2.0 | 97.0 | 260.0 | 5.098 | 1673.0 | 9 |
| 1595.0 | 51 | 51 | 5.0 | 255.0 | 515.0 | 10.098 | 4664 | 9 |

$$① A_i = [(L_1 + L_2) / 2] H_i$$

TOP = TOP OF DAM (LOW POINT)

$$② H_W = A_T / L,$$

C = 2.85 FROM PAGE A -

$$③ Q = C L_i H_W^{3/2}$$

SPILLWAY RATING TABLE

| RESERVOIR ELEVATION (MSL) | Q (CFS) |
|---------------------------|---------|
| 1583.0 | 0 |
| 1584.0 | 60 |
| 1585.0 | 180 |
| 1586.0 | 350 |
| 1587.0 | 580 |
| 1587.6 *TOP | 750 |
| 1588.0 | 870 |
| 1589.0 | 1670 |
| 1595.0 | 4660 |

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAMSHEET 8 OF 8 SHEETSCOMPUTED BY JTB

CHECKED BY _____

DATE 5-19-81EMBANKMENT RATING TABLE:

THIS ANALYSIS ASSUMES THAT THE EMBANKMENT BEHAVES AS A BROAD-CRESTED WEIR IF OVERTOPPING OCCURS. THIS DISCHARGE CAN BE ESTIMATED BY:

$$Q = C L_i H_w^{3/2}$$

where:

 Q = DISCHARGE OVER EMBANKMENT, IN CFS L_i = LENGTH OF EMBANKMENT, IN FEET H_w = WEIGHTED HEAD, IN FEET, AVERAGE FLOW AREA

C = COEFFICIENT DISCHARGE

$C=2.85$ FROM VARWELL & NAGLER FOR BROAD-CRESTED WEIR

LENGTH OF EMBANKMENT INNUNDATE
VS. RESERVOIR ELEVATION:

| RESERVOIR ELEVATION (MSL) | EMBANKMENT LENGTH (FT) |
|------------------------------|---------------------------|
| 1587.6 | 0 |
| 1588.0 | 50 |
| 1589.0 | 340 |
| 1590.0 | 600 |
| 1591.0 | 820 * |
| 1592.0 | 820 * |
| 1595.0 | 820 * |

* MAXIMUM LENGTH OF EMBANKMENT LESS SPILLWAY WIDTH
AND OVERBANK AREA.

BALTIMORE DISTRICT, CORPS OF ENGINEERS

PAGE _____

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAM SHEET 9 OF 10 SHEETSCOMPUTED BY JPB CHECKED BY _____ DATE 5-19-81EMBANKMENT RATING:

| RESERVOIR ELEVATION (MSL) | L_1, L_2 | | INCREMENTAL HEAD, H_i (ft) | INCREMENTAL FLOW AREA, A_i (ft^3) | TOTAL FLOW AREA AT A_i (ft^3) | $H_{w,i}$ (ft) | Q (CFS) | $C = 2.85$ |
|---------------------------|------------|--------|------------------------------|---|-------------------------------------|----------------|-----------|------------|
| | (ft) | (ft) | | | | | | |
| 1587.6 | 0 | - | - | - | - | - | - | 0 |
| 1588.0 | 50 | 0 | 0.4 | 10 | 10 | 0.20 | 12.7 | |
| 1589.0 | 340 | 50 | 1.0 | 195 | 205 | 0.603 | 453.7 | |
| 1590.0 | 600 | 340 | 1.0 | 470 | 675 | 1.125 | 2040.5 | |
| 1591.0 | 820 | 600 | 1.0 | 710 | 1385 | 1.689 | 5129.9 | |
| 1592.0 | 820 | 820 | 1.0 | 820 | 2205 | 2.689 | 10304.9 | |
| 1595.0 | 820 | 820 | 3.0 | 2460 | 4665 | 5.689 | 31711.3 | |

$$\textcircled{1} \quad A_i = [(L_1 + L_2)/2] H_i$$

$$\textcircled{2} \quad H_{w,i} = A_i/L_i$$

$$\textcircled{3} \quad Q = C L_i H_{w,i}^{3/2}$$

TOTAL FACILITY RATING CURVE:

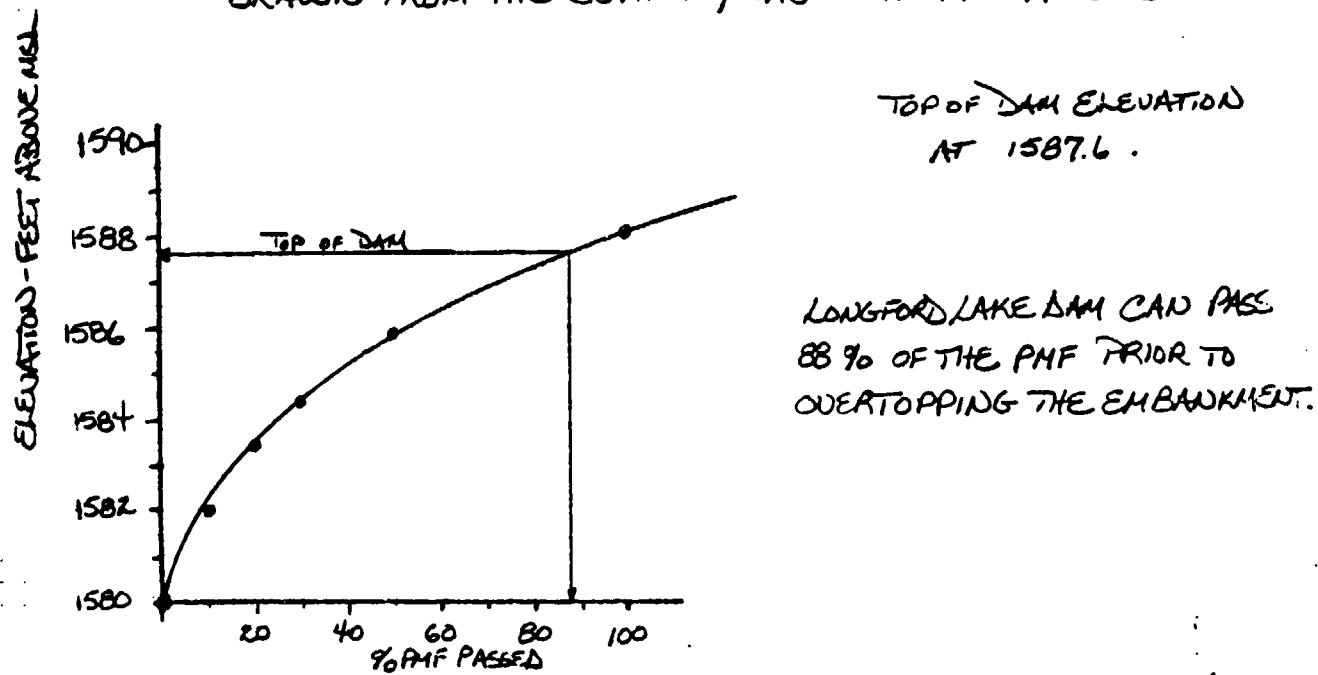
| RESERVOIR ELEVATION (MSL) | $Q_{SPILLWAY}$ (CFS) | $Q_{EMBANKMENT}$ (CFS) | Q_{TOTAL} (CFS) | |
|---------------------------|----------------------|------------------------|-------------------|-------------|
| 1583.0 | 0 | 0 | 0 | |
| 1584.0 | 60 | 0 | 60 | |
| 1585.0 | 180 | 0 | 180 | THIS DATA |
| 1586.0 | 350 | 0 | 350 | TO BE INPUT |
| 1587.6 | 750 | 0 | 750 | ON 44 345 |
| 1588.0 | 870 | 13 | 883 | CARDS. |
| 1590.0 | 1670 | 2040 | 3710 | |
| 1595.0 | 4665 | 31710 | 36370 | |

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAMSHEET 10 OF 10 SHEETSCOMPUTED BY JPB

CHECKED BY _____

DATE 5-22-81RESULTS OF THE OVERTOPPING ANALYSIS:

FROM PAGE D-20, THE FOLLOWING CURVE CAN BE DRAWN FROM THE SUMMARY TABLE IN THIS APPENDIX.



THIS FACILITY CAN CONTROL 88% OF THE PMF. AT THE SDF (FULL PMF) THE DAM IS OVERTOPPED TO A MAXIMUM HEIGHT OF 0.51 FEET FOR A TOTAL DURATION OF 2.0 HOURS. SINCE THIS FACILITY CAN PASS $\frac{1}{2}$ PMF WITHOUT OVERTOPPING BUT CANNOT PASS THE SDF (FULL PMF), THE SPILLWAY IS RATED AS INADEQUATE. NO BREACH ANALYSIS IS REQUIRED.

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAM SHEET 11 OF 11 SHEETSCOMPUTED BY JMB CHECKED BY _____ DATE 8-20-81OUTLET WORKS:

THE OUTLET WORKS CONSISTS OF A 24-INCH DIAMETER REINFORCED CONCRETE CONDUIT, WITH A CONCRETE RISER AND POND DRAIN. THE 24-INCH CONDUIT DISCHARGES INTO A REINFORCED CONCRETE IMPACT-TYPE ENERGY DISSIPATOR.

DATA :

| | |
|--------------------------------|--------|
| CREST OF INLET (NORMAL POOL) - | 1580.0 |
| ORIFICE FLOW BEGINS AT ELEV - | 1580.5 |

POND DRAIN -

| | |
|---------------------------|------------|
| 12 INCH DUCTILE IRON PIPE | |
| UPSTREAM INVERT - | 1555.0 |
| DOWNSTREAM INVERT - | 1554.5 |
| LENGTH - | 51.0 FEET |
| SLOPE - | 0.01 FT/FT |

OUTLET PIPE -

| | |
|--|-------------|
| 24 INCH PRESTRESSED CONCRETE PRESSURE PIPE | |
| UPSTREAM INVERT - | 1554.0 |
| DOWNSTREAM INVERT - | 1552.0 |
| LENGTH - | 122 FEET |
| SLOPE - | 0.016 FT/FT |

SEE APPENDIX E FOR DETAILS ON OUTLET WORKS. FLOWS WILL BE CALCULATED FOR WEIR FLOW, PRESSURE FLOW AND PIPE FLOW. OUTFLOW RATING CURVE WILL BE CALCULATED FOR:

- 1) WEIR FLOW - ELEVATION 1580 TO 1580.5
- 2) PRESSURE FLOW OR PIPE FLOW ABOVE THAT DEPENDING ON WHICH WOULD CONTROL.

SUBJECT DAM SAFETY ANALYSISCOMPUTATIONS LONGFORD LAKE DAMSHEET 12 OF 12 SHEETSCOMPUTED BY JPB

CHECKED BY _____

DATE 8-28-87

$$\text{WEIR FLOW: } Q = C L H^{3/2}$$

where: Q = FLOW IN CFS L = LENGTH OF WEIR (12 FEET) C = COEFFICIENT OF DISCHARGE (2.85) H = HEAD ON WEIR (POOL EL - 1580.0)

WEIR FLOW APPLICABLE BETWEEN EL. 1580 TO 1580.5

$$\text{PRESSURE FLOW: } Q = C A \sqrt{2 g H}$$

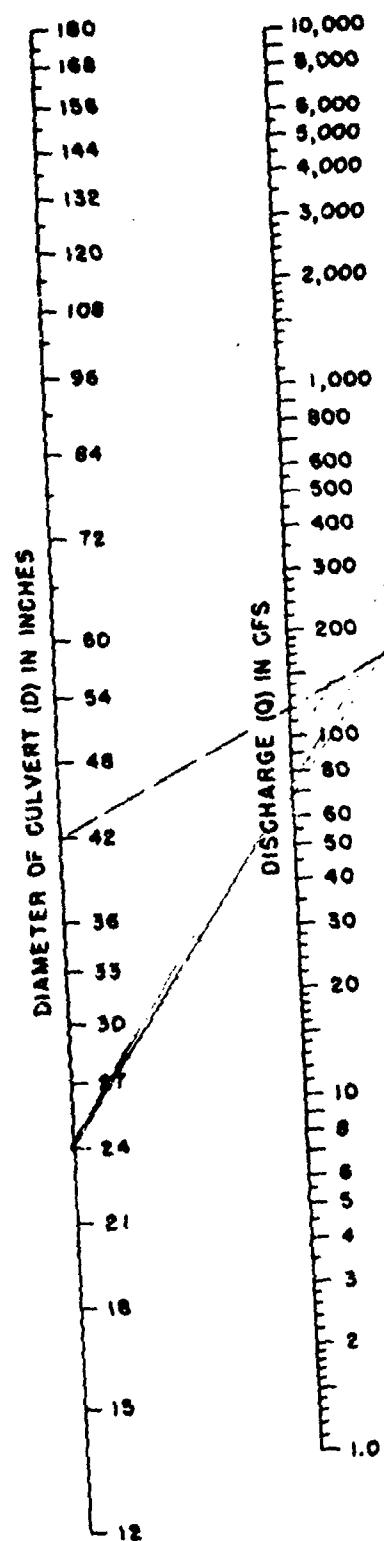
where: Q = FLOW IN CFS A = FLOW AREA IN FT^2 , $(2\frac{1}{2} \times 6) = 6 \text{ FT}^2$ g = gravity, 32.2 FT/SEC^2 H = DIFFERENTIAL HEAD, (POOL ELEV - 1580.0)

PIPE FLOW: ASSUMES RISER INTAKE FILLED,
 NO TAILWATER TO ELEVATION 1583.0, AND
 VARIABLE ABOVE. (THIS ANALYSIS USES CHARTS IN
 THIS APPENDIX TO COMPUTE OUTFLOW)

| POOL ELEV. (MSL) | H (FT) | WEIR FLOW (CFS) | PRESSURE FLOW (CFS) | ① | | ② TAILWATER H _T (ELEV) (FT) | PIPE FLOW (CFS) | USE (CFS) |
|---------------------|-----------|-----------------------|---------------------------|---------|--|---|-----------------------|--------------|
| | | | | HW D | TAILWATER H _T (ELEV) (FT) | | | |
| 1580.0 | 0 | 0 | - | - | - | - | - | 0 |
| 1580.5 | 0.5 | 12.1 | n/a | 13.3 | n/a | 4/1 | 68 | 12.1 |
| 1581.0 | 1.0 | n/a | 28.8 | 13.5 | n/a | 4/1 | 70 | 28.8 |
| 1583.0 (SAW) | 3.0 | n/a | 50.0 | 14.5 | n/a | 4/1 | 72 | 50.0 |
| 1585.0 | 5.0 | n/a | 64.6 | 15.5 | 1557.0 | 28 | 72 | 64 |
| 1587.0 | 7.0 | n/a | 76.4 | 16.5 | 1560.0 | 27 | 77 | 76 |
| 1587.6 (TOP) | 7.6 | n/a | 80.0 | 16.8 | 1563.0 | 24.6 | 80 | 80 |

n/a - NOT APPLICABLE

① HW/D where $D = 2 \text{ FT}$ AND $HW = (\text{POOL ELEV} - 1554.0)$ ② $H_T = (\text{POOL ELEV} - \text{TAILWATER})$ THEREFORE, APPROXIMATE OUTFLOW FROM
 OUTLET WORKS IS = 80 CFS.



HEADWATER SCALES 283
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN 1963

CHART 2

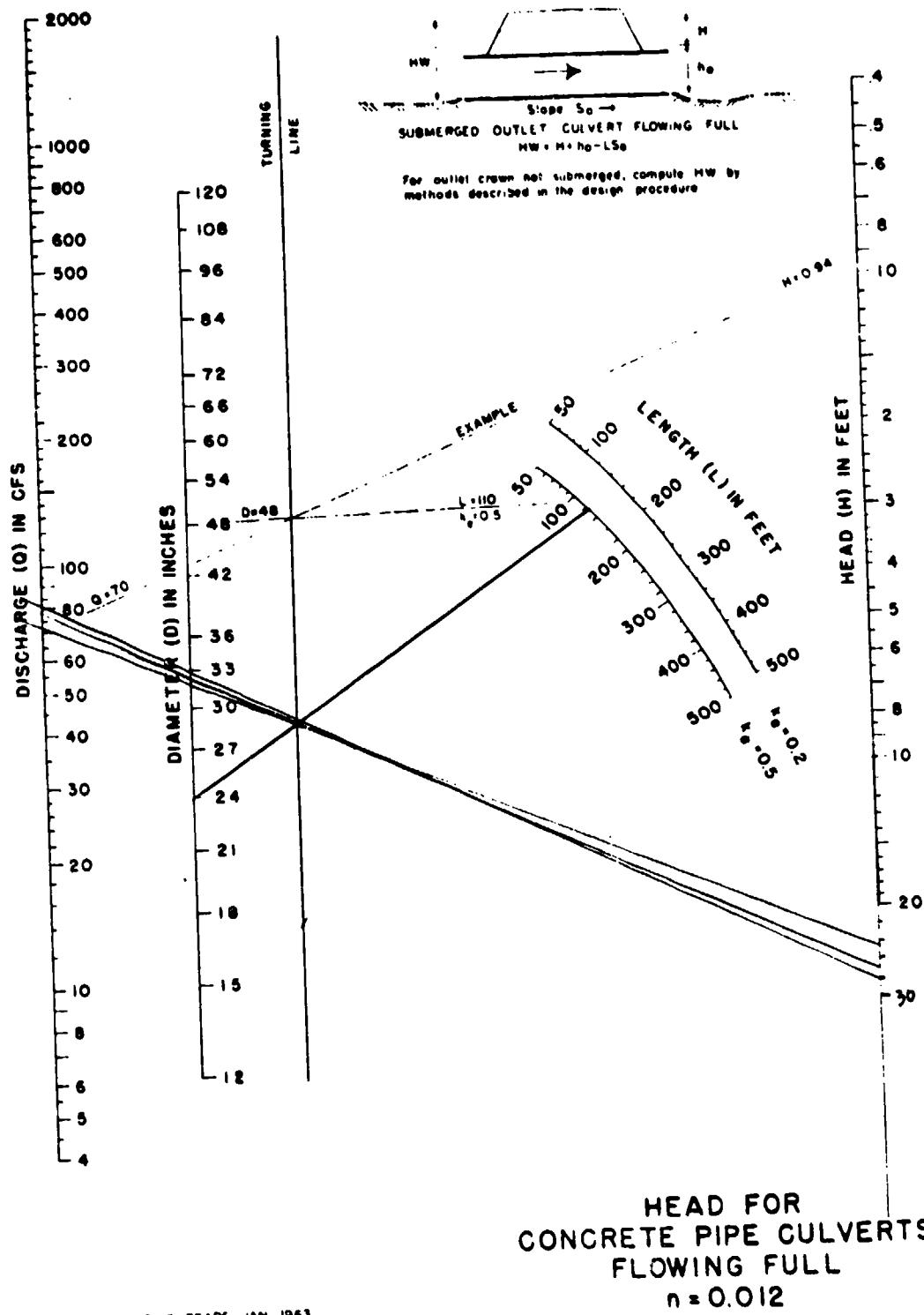
| (1) | (2) | (3) |
|-----|-----|-----|
| 8. | 5. | 5. |
| 6. | 4. | 4. |
| 5. | 3. | 3. |
| 4. | 2. | 2. |
| 3. | | |
| 2. | 1.5 | 1.5 |
| 1.5 | | |
| | 1.0 | 1.0 |
| | .9 | .9 |
| | .8 | .8 |
| | .7 | .7 |
| | .6 | .6 |
| | .5 | .5 |

HEADWATER DEPTH FOR
CONCRETE PIPE CULVERTS
WITH INLET CONTROL

INLET CONTROL

LONGFORD LAKE DAM

CHART 9



OUTLET CONTROL

LONGFORD LAKE DAM

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 01 APR 80

1 A1 LONGFORD POND DAM DER NO. 70-58-137
 2 A2 DAM SAFETY INSPECTION PROGRAM 5-22-81
 3 A3 OVERTOPPING ANALYSIS *** PRELIMINARY ***
 4 B 144 0 20 0 0 0 0 0 0 0 0 0
 5 B1 5 0 0 0 0 0 0 0 0 0 0 0
 6 J 1 5 1
 7 J1 0.10 0.20 0.30 0.50 1.00
 8 K 0 1 0 0 0 0 0 1 0 0 0 0
 9 K1 RUNOFF FROM DRAINAGE AREA ABOVE LONGFORD POND DAM
 10 M 1 1 0.39 0 0.39 0 0 0 0 1 0
 11 P 0 22.2 113.5 123.2 131.9 138.7 140.7
 12 T 0 0 0 0 0 0 1.0 0.05 0 0 0
 13 H 1.06 0.62
 14 X -1.5 -0.05 2
 15 K 1 1 0 0 0 0 0 1 0 0 0 0
 16 K1 ROUTING ZPMF'S THRU LONGFORD POND DAM
 17 Y 0 0 0 1 1 0 0 0 0 0 0 0
 18 Y1 1 0 0 0 0 0 -1580.0 -1 0 0 0
 19 Y4 1583 1584 1585 1586 1587.6 1588 1590 1595
 20 Y5 0 60 180 350 750 883 3710 36370
 21 S 0 159 232 258 311 355 366 425 580
 22 \$E1580.2 1580 1583 1584 1586 1587.6 1588 1590 1595
 23 \$S1583.0
 24 \$D1587.6
 25 K 99

1 PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
 ROUTE HYDROGRAPH TO 1
 END OF NETWORK

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 01 APR 80

RUN DATE: 81/09/02.
 TIME: 08.08.18.

LONGFORD POND DAM DER NO. 70-58-137
 DAM SAFETY INSPECTION PROGRAM 5-22-81
 OVERTOPPING ANALYSIS *** PRELIMINARY ***

JOB SPECIFICATION

| NO | NHR | NMIN | IDAY | IHR | IMIN | METRC | IPLT | IPRT | INSTAN |
|-----|-----|------|-------|-----|-------|-------|------|------|--------|
| 144 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | JOPER | MNT | LROPT | TRACE | | | |
| | | | 5 | 0 | 0 | 0 | | | |

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRTIO= 5 LRTIO= 1
 RTIOS= .10 .20 .30 .50 1.00

J-18

LONGFORD LAKE
 OVERTOPPING ANALYSIS
 P-12 V2

***** ***** ***** ***** *****

SUB-AREA RUNOFF COMPUTATION

RUNOFF FROM DRAINAGE AREA ABOVE LONGFORD POND DAM

| ISTAO | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|-------|-------|-------|-------|------|------|-------|--------|-------|
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

| HYDROGRAPH DATA | | | | | | | | | |
|-----------------|------|-------|------|-------|-------|-------|-------|-------|-------|
| IHYDG | IUNG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
| 1 | 1 | .39 | 0.00 | .39 | 0.00 | 0.000 | 0 | 1 | 0 |

| PRECIP DATA | | | | | | | |
|-------------|-------|--------|--------|--------|--------|--------|------|
| SPFE | PMS | R6 | R12 | R24 | R48 | R72 | R96 |
| 0.00 | 22.20 | 113.50 | 123.20 | 131.90 | 138.70 | 140.70 | 0.00 |

TRSPC COMPUTED BY THE PROGRAM IS .800

| LOSS DATA | | | | | | | | | | |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| LROPT | STRKR | DLTKR | RTIOL | ERAIN | STRKS | RTIOK | STRTL | CNSTL | ALSMX | RTIMP |
| 0 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | .05 | 0.00 | 0.00 |

| UNIT HYDROGRAPH DATA | | |
|----------------------|------|----------------|
| TP= | 1.06 | CP= .62 NTA= 0 |

RECEDITION DATA

STRTG= -1.50 QRCSE= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 3.86 AND R= 2.85 INTERVALS

UNIT HYDROGRAPH 18 END-OF-PERIOD ORDINATES, LAG= 1.06 HOURS, CP= .62 VOL= 1.00

| | | | | | | | | | |
|-----|-----|------|------|------|-----|-----|-----|-----|-----|
| 21. | 74. | 127. | 142. | 117. | 82. | 57. | 40. | 28. | 20. |
| 14. | 10. | 7. | 5. | 3. | 2. | 2. | 1. | | |

***** ***** ***** ***** *****

HYDROGRAPH ROUTING

ROUTING %PMF'S THRU LONGFORD POND DAM

| ISTAO | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|-------|-------|-------|-------|------|------|-------|--------|-------|
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

| ROUTING DATA | | | | | | | | | |
|--------------|-------|------|------|-------|------|------|------|--|--|
| GLOSS | CLOSS | Avg | IRES | ISAME | IOPT | IPMP | LSTR | | |
| 0.0 | 0.000 | 0.00 | 1 | 1 | 0 | 0 | 0 | | |

| NSTPS | NSTOL | LAG | AMSKK | X | TSK | STORA | ISPRAT |
|-------|-------|-----|-------|-------|-------|--------|--------|
| 1 | 0 | 0 | 0.000 | 0.000 | 0.000 | -1590. | -1 |

| | | | | | | | | |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|
| STAGE | 1583.00 | 1584.00 | 1585.00 | 1586.00 | 1587.60 | 1588.00 | 1590.00 | 1595.00 |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|

| | | | | | | | | |
|------|------|-------|--------|--------|--------|--------|---------|----------|
| FLOW | 0.00 | 60.00 | 180.00 | 350.00 | 750.00 | 883.00 | 3710.00 | 36370.00 |
|------|------|-------|--------|--------|--------|--------|---------|----------|

| | | | | | | | | | |
|-----------|----|------|------|------|------|------|------|------|------|
| CAPACITY= | 0. | 159. | 232. | 258. | 311. | 353. | 366. | 425. | 580. |
|-----------|----|------|------|------|------|------|------|------|------|

| | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ELEVATION= | 1560. | 1580. | 1583. | 1584. | 1586. | 1588. | 1588. | 1590. | 1595. |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

| CREL | SPWID | CQW | EXPW | ELEV | COOL | CAREA | EXPL |
|--------|-------|-----|------|------|------|-------|------|
| 1583.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| DAM DATA | | | |
|----------|------|------|--------|
| TOPEL | COQD | EXPD | DAMWID |
| 1587.6 | 0.0 | 0.0 | 0. |

D-19

Longford Lake Dam
Overtopping Analysis

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

| OPERATION | STATION | AREA | RATIOS APPLIED TO FLOWS | | | | | |
|---------------|--------------|--------------|-------------------------|------------------|------------------|------------------|----------------|-----------------|
| | | | PLAN | RATIO 1 .10 | RATIO 2 .20 | RATIO 3 .30 | RATIO 4 .50 | RATIO 5 1.00 |
| HYDROGRAPH AT | 1 (1.01) | 1 (3.83) | 135. (7.65) | 270. (11.48) | 405. (19.13) | 676. (38.26) | 1351. () | |
| ROUTED TO | 1 (1.01) | 1 (0.00) | 0. (.79) | 28. (3.30) | 117. (9.43) | 333. (29.28) | 1034. () | |

SUMMARY OF DAM SAFETY ANALYSIS

| PLAN 1 | ELEVATION | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|--------------|-----------|---------------|----------------|------------|
| | STORAGE | 1580.00 | 1583.00 | 1587.60 |
| | OUTFLOW | 159. | 232. | 355. |
| | | 0. | 0. | 750. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|--------------------|----------------------------------|------------------------------|-----------------------------|---------------------------|-------------------------------|---------------------------------|-----------------------------|
| .10 | 1581.98 | 0.00 | 207. | 0. | 0.00 | 0.00 | 0.00 |
| .20 | 1583.46 | 0.00 | 244. | 28. | 0.00 | 44.33 | 0.00 |
| .30 | 1584.47 | 0.00 | 271. | 117. | 0.00 | 43.33 | 0.00 |
| .50 | 1585.90 | 0.00 | 308. | 333. | 0.00 | 42.67 | 0.00 |
| 1.00 | 1588.11 | .51 | 369. | 1034. | 2.00 | 41.33 | 0.00 |

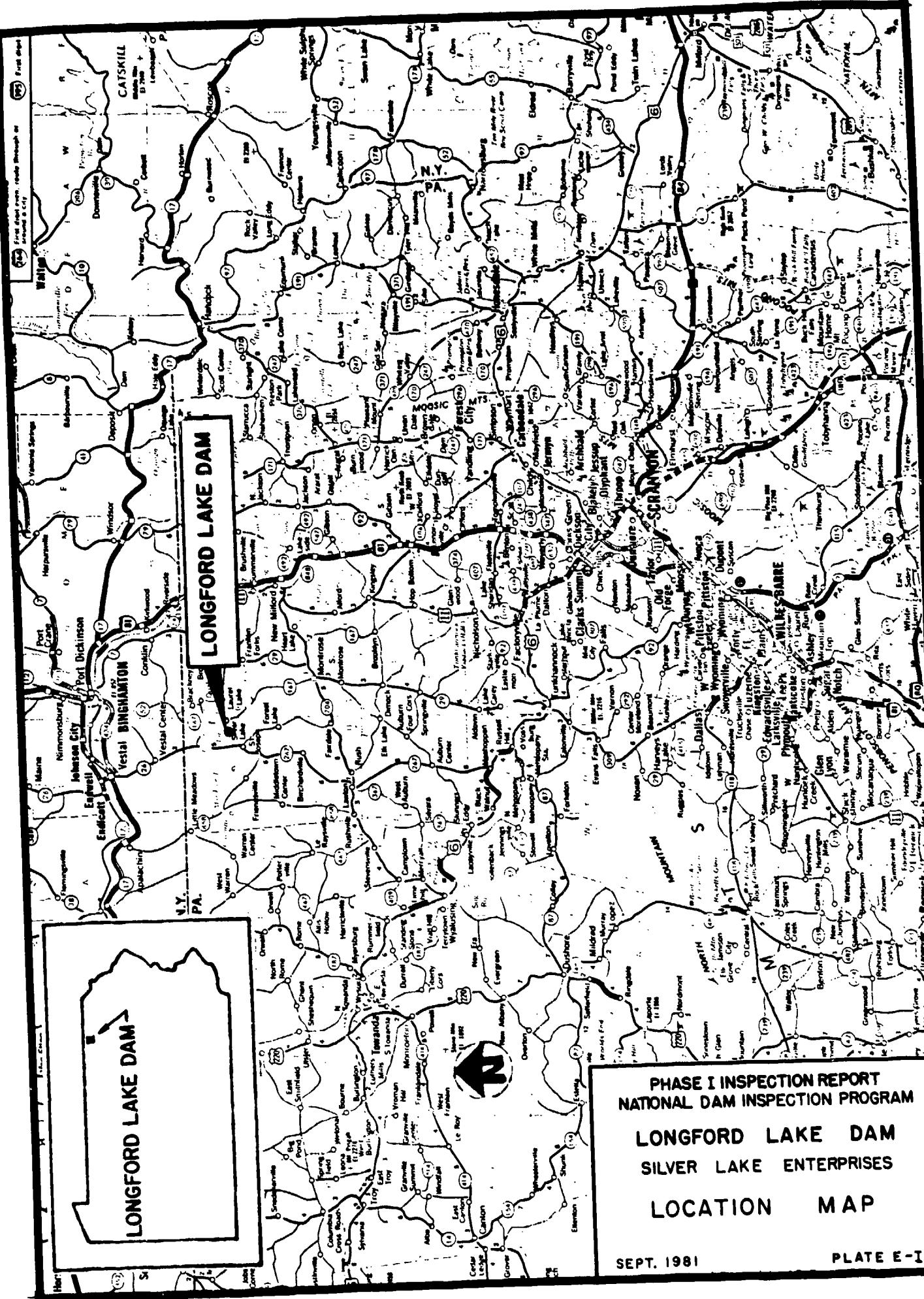
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 01 APR 80

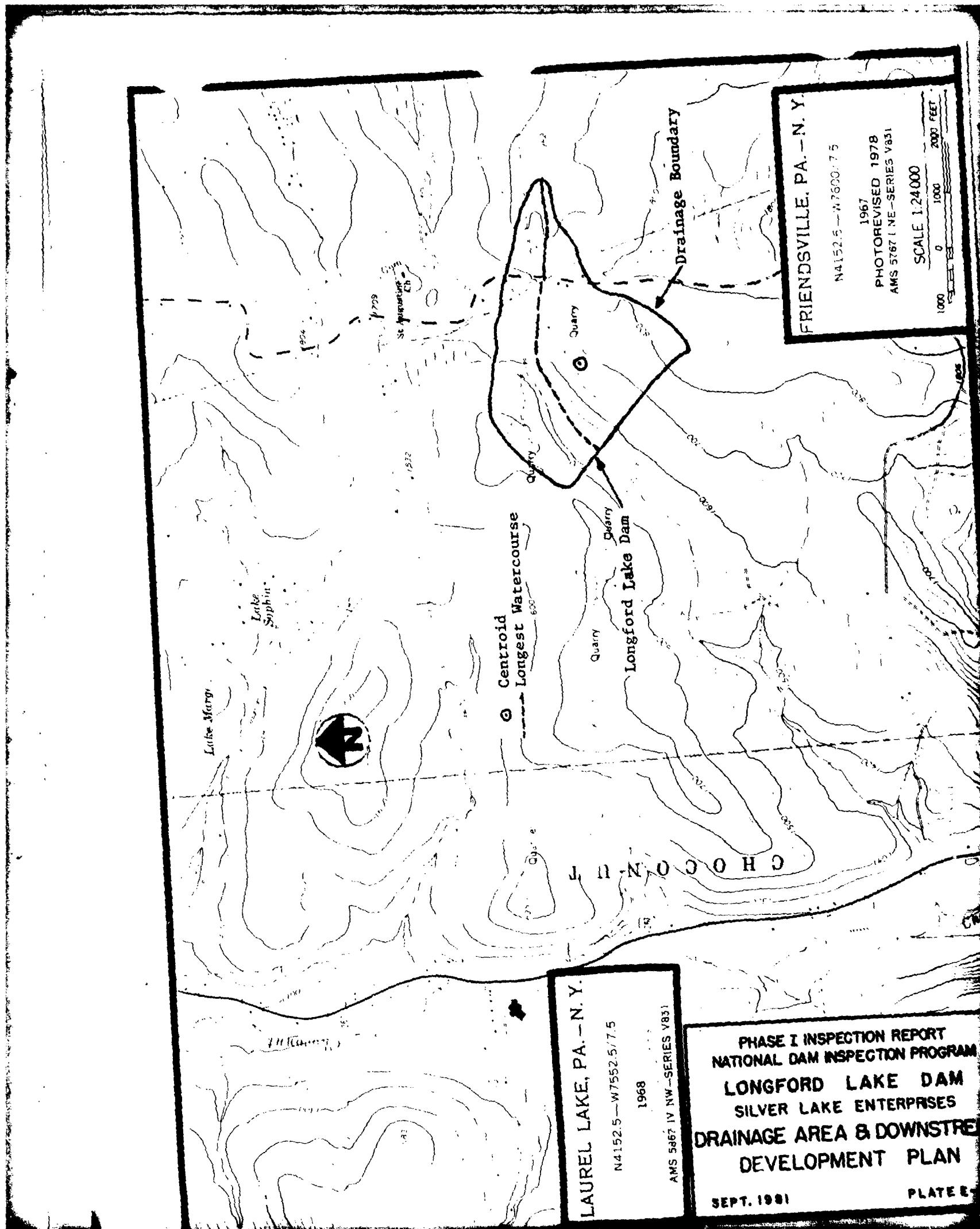
LONGFORD LAKE DAM
 OVERTOPPING ANALYSIS
 Page 3/3

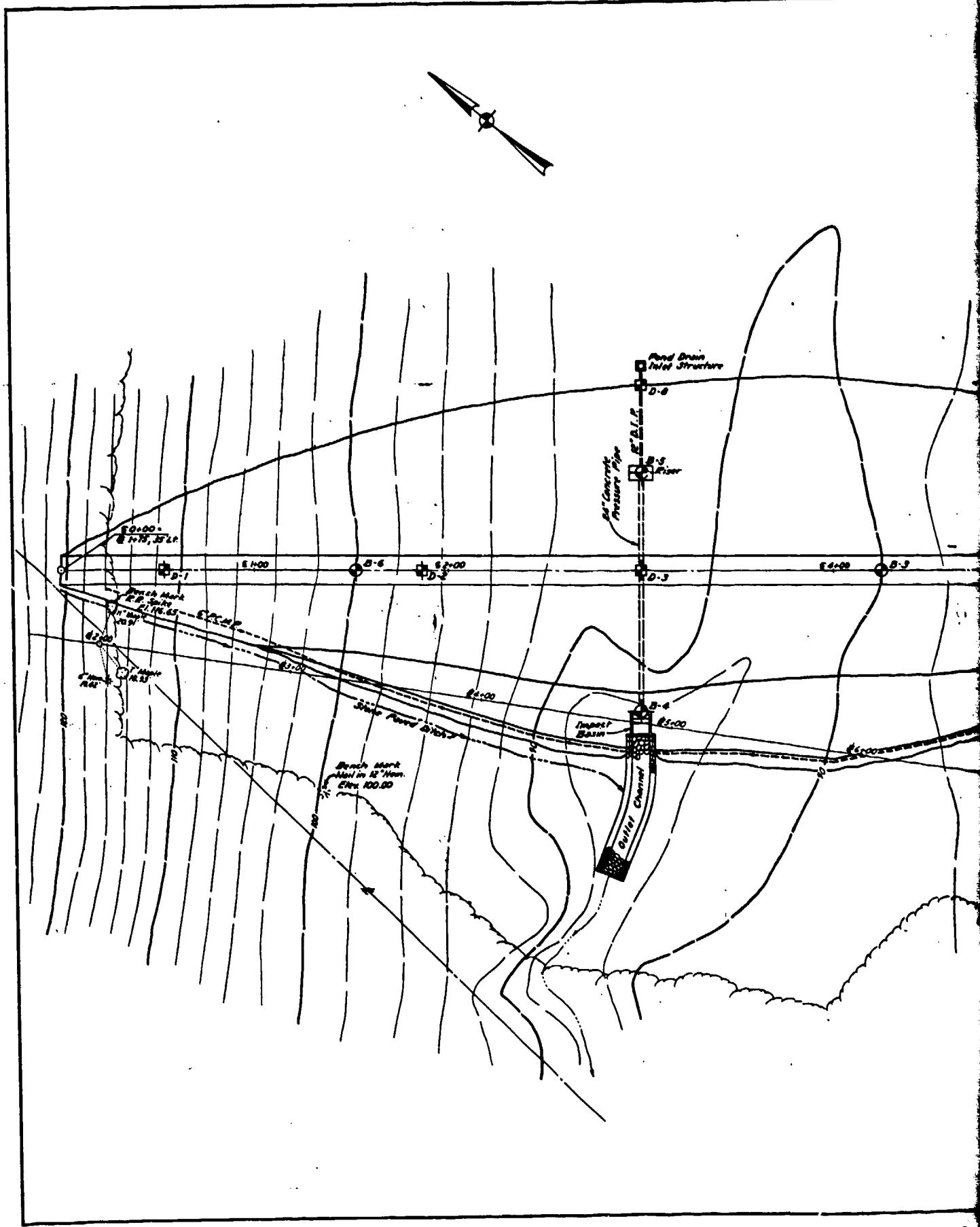
D-20

APPENDIX E

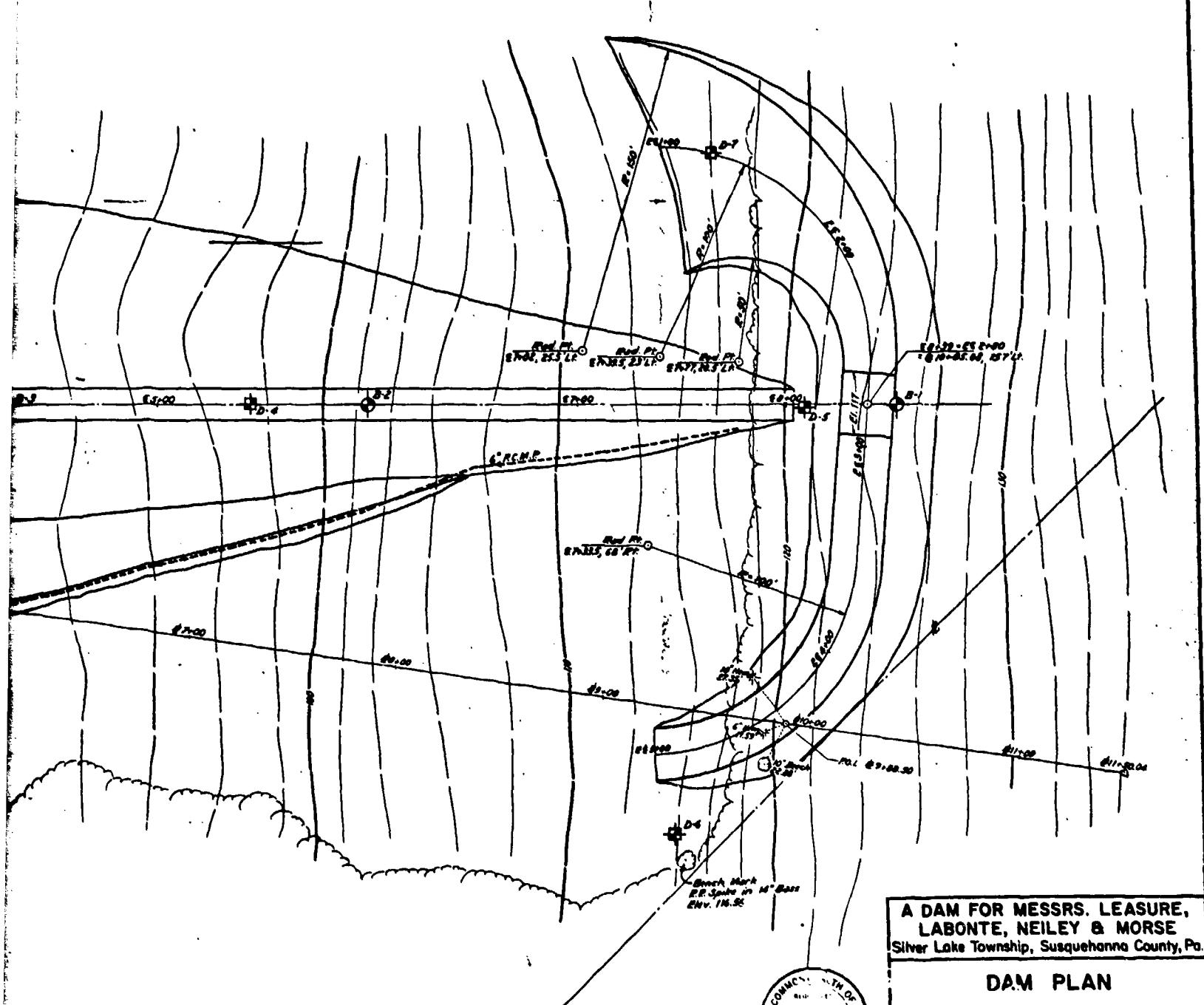
PLATES







Please To Margin of 11"
Then Add To 8 1/2" x 11"



**A DAM FOR MESSRS. LEASURE,
LABONTE, NEILEY & MORSE
Silver Lake Township, Susquehanna County, Pa.**

DAM PLAN

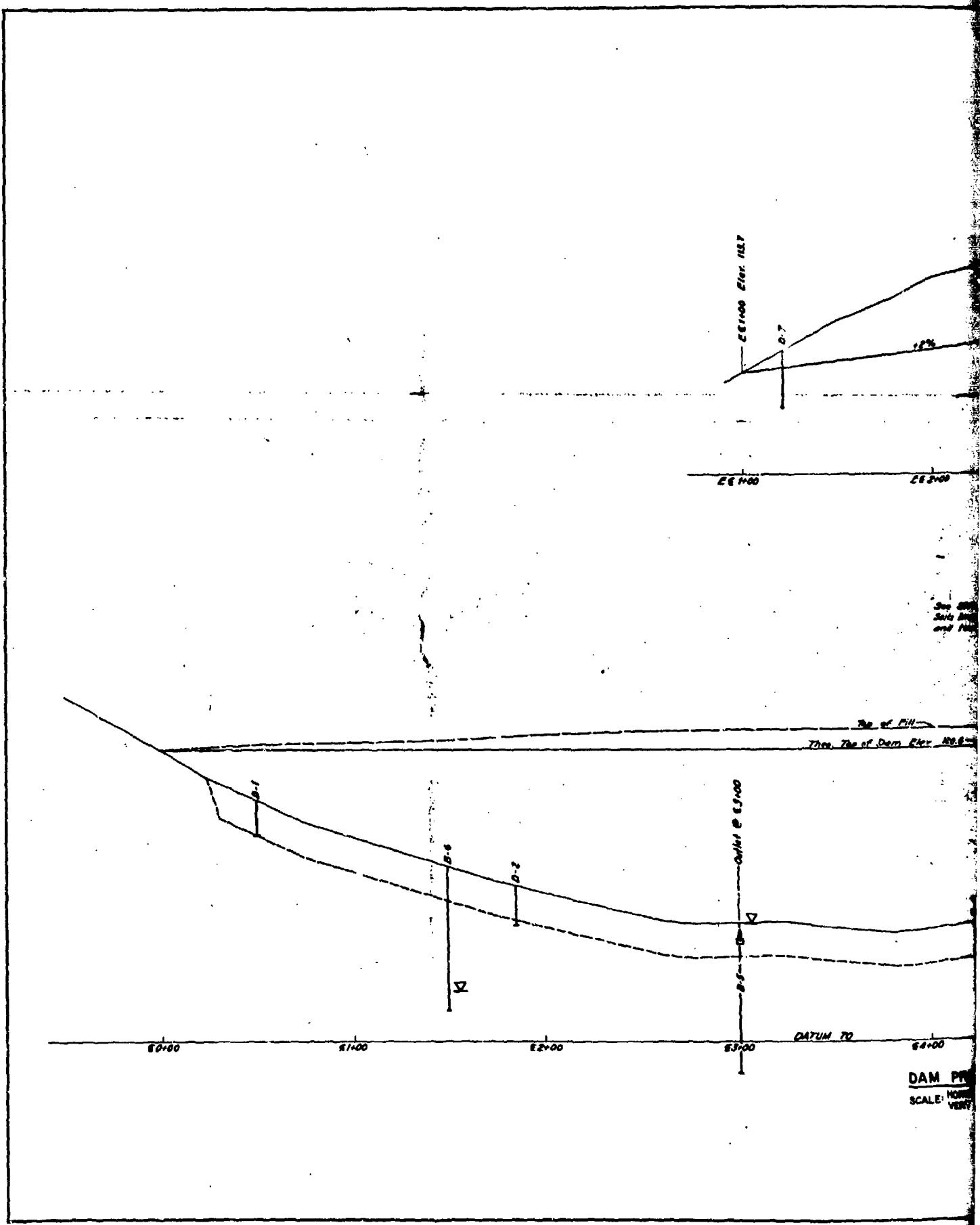
Scale 1" = 30'

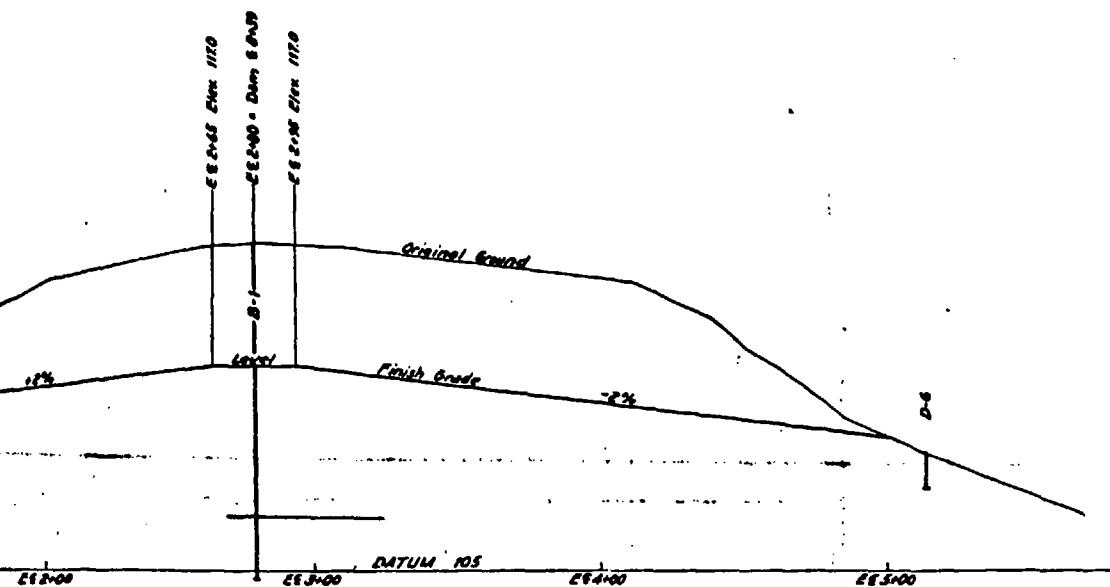
Sheet 3 of 8

Sheet 3 of 8

THE BOSTONIAN

Received March 11, 1974

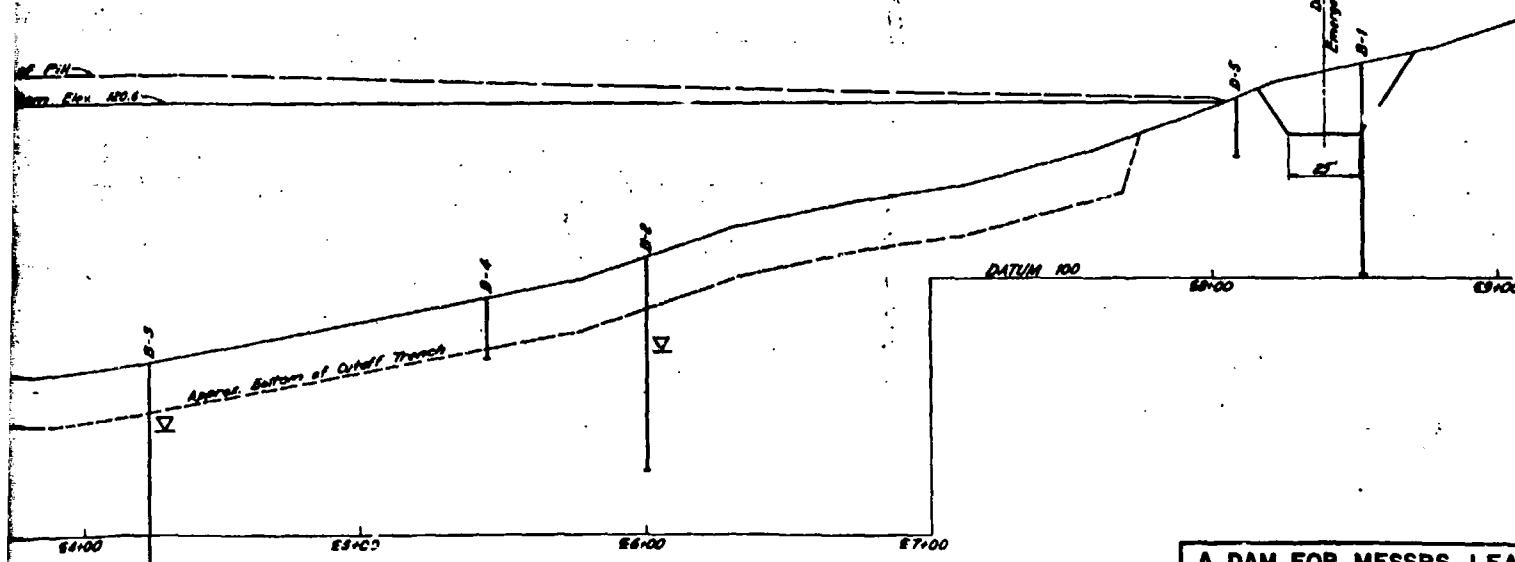




EMERGENCY SPILLWAY PROFILE

SCALE: HORIZ. 1"=30'
VERT. 1"=5'

See Soil & FOUNDATION STUDY by Empire
Soil Investigations Inc. for logs of borings
and test pits.



DAM PROFILE

SCALE: HORIZ. 1"=30'
VERT. 1"=10'

A DAM FOR MESSRS. LEASURE,
LABONTE, NEILEY & MORSE
Silver Lake Township, Susquehanna County, Pa.

PROFILES

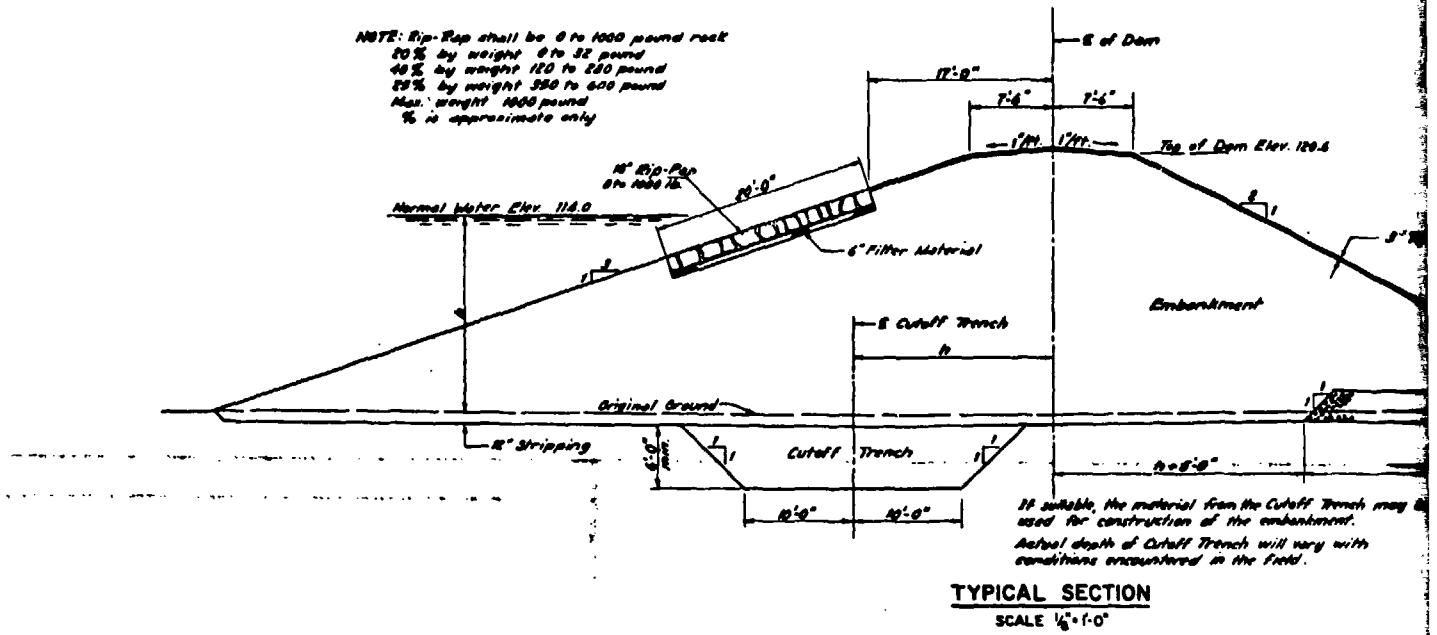


R. J. Martin
Consulting Engineer

Scale As Needed
Date Oct 10, 1973

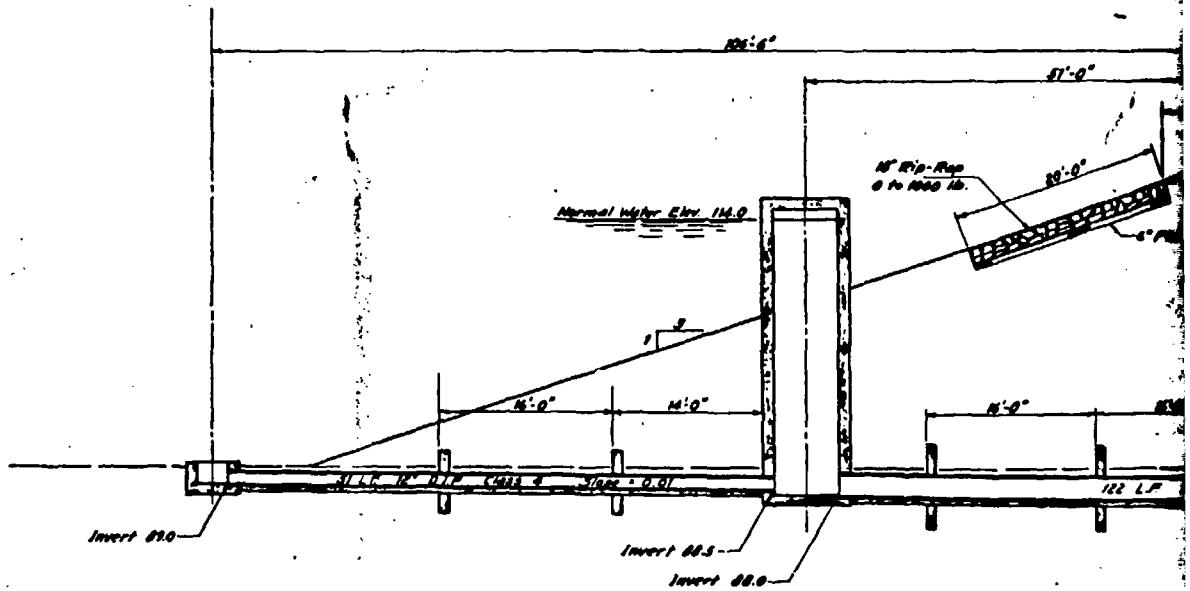
Sheet 4 of 8

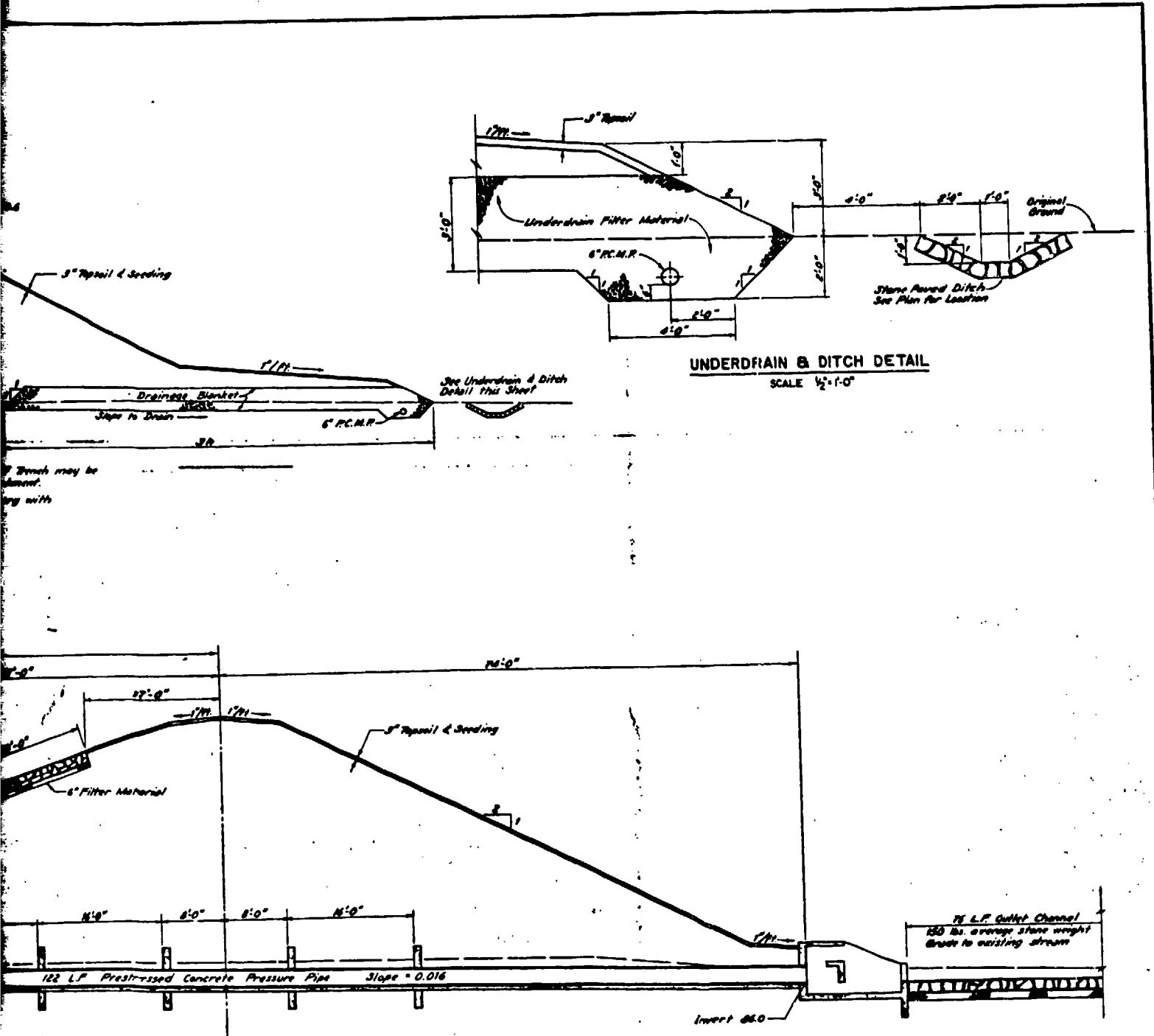
NOTE: Rip-Rap shall be 0 to 1000 pound rock
 20% by weight 0 to 32 pound
 40% by weight 120 to 200 pound
 38% by weight 380 to 600 pound
 Max. weight 1000 pound
 % is approximate only



TYPICAL SECTION

SCALE $1/8" \times 1'-0"$





SECTION AT CENTERLINE 3+00

AT CENTER
SCALE 45'-0"



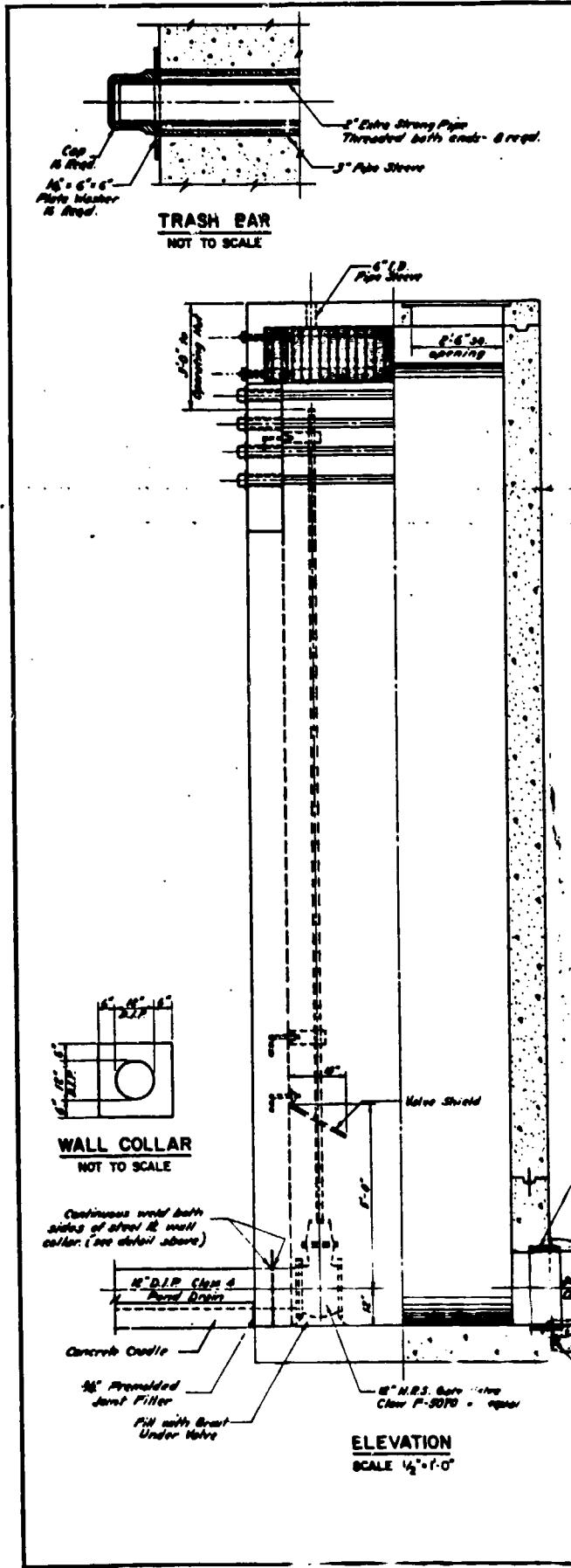
A DAM FOR MESSRS. LEASURE,
LABONTE, NEILEY & MORSE
Silver Lake Township, Susquehanna County, Pa.

OUTLET PROFILE

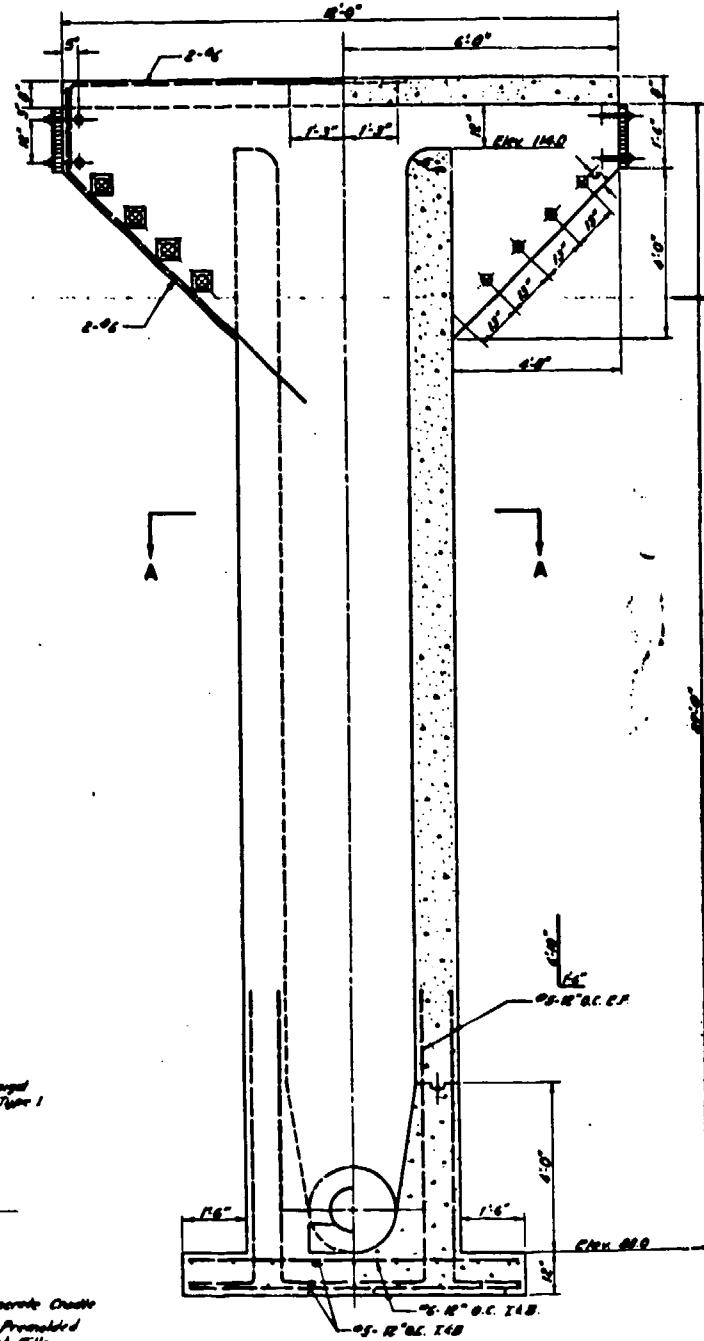
The logo for R. J. Martin Consulting Engineer. It features a circular emblem on the left with the word "Martin" in a stylized font, overlaid on a wavy line representing water. To the right of the emblem, the company name is written in a serif font, with "Consulting Engineer" in a smaller size below "R. J. Martin". Below the company name is the address "West 10th Street 12300". A handwritten signature "R. J. Martin" is written across the bottom of the card.

Scout As Mated

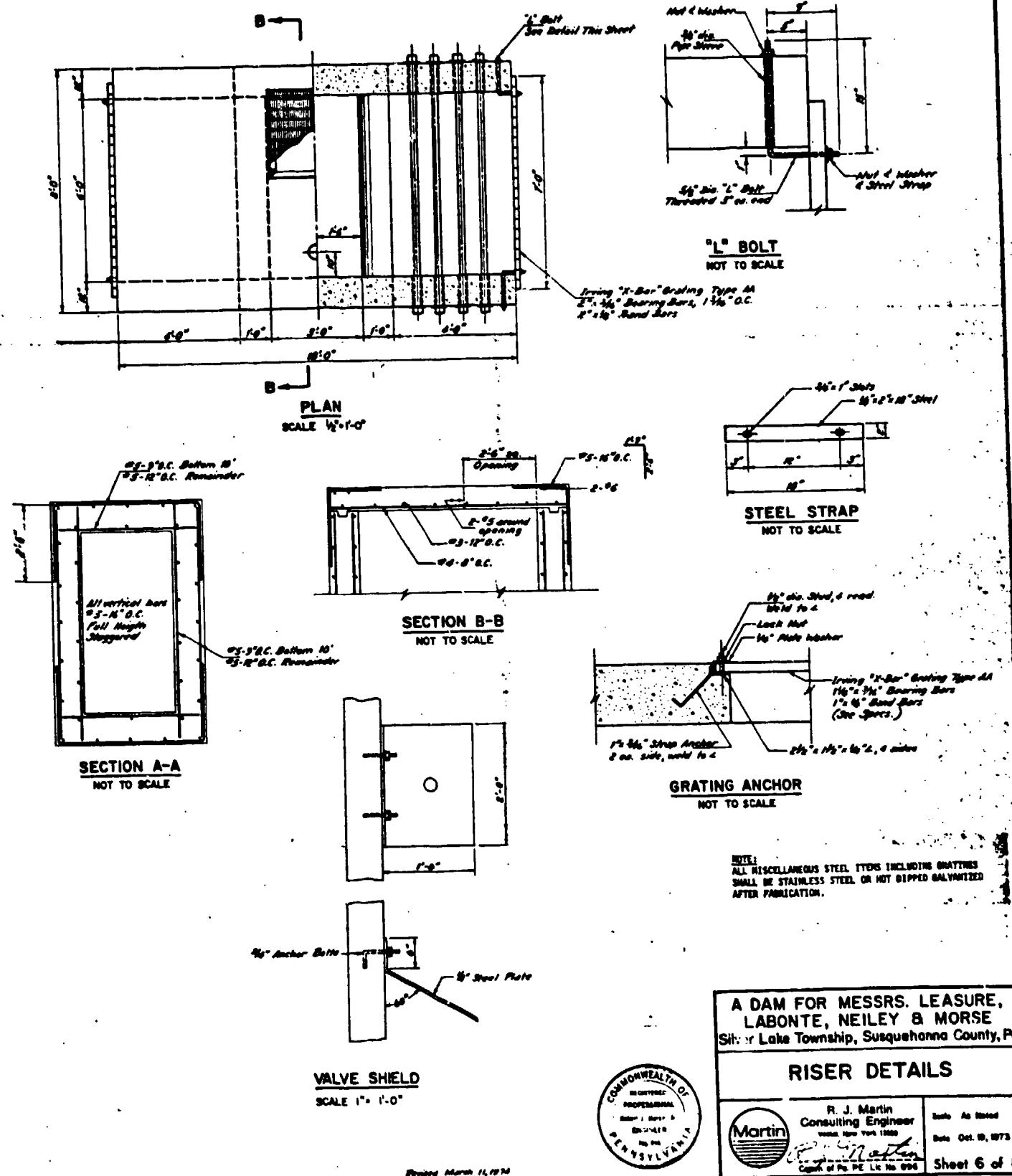
Sheet 5 of 8

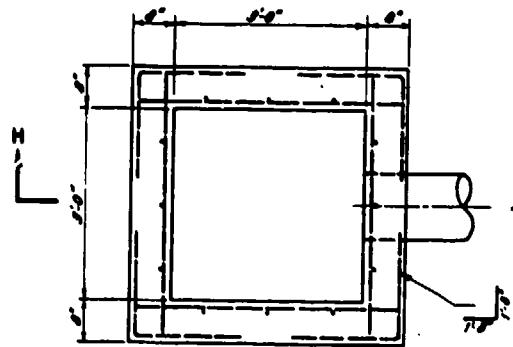


NOTE: All exposed edges of concrete shall have 45° chamfer.

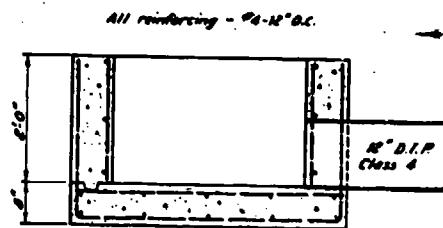


UPSTREAM ELEVATION
SCALE $4\frac{1}{2}'' = 1'-0''$





PLAN

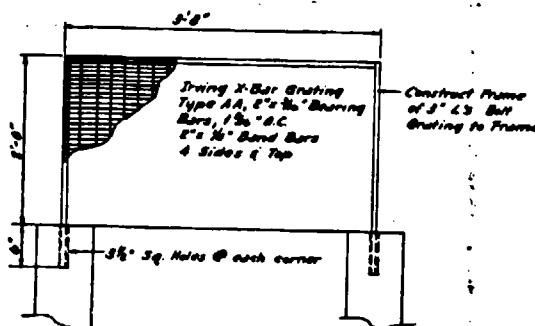


SECTION H-H
POND DRAIN INLET STRUCTURE

SCALE $3\frac{1}{4}'' = 1'-0''$

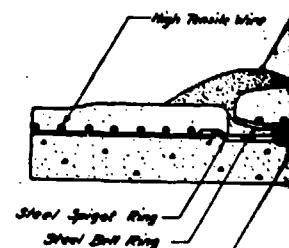
Construct 80' x 10' x 8' deep Sedimentation Basin as the first operation of the construction project. When a suitable stand of grass exists on the dam if emergency calling the basin shall be filled in the rip-rap outlet channel constructed in its place.

SECTION - EMERGENCY
NOT TO SCALE

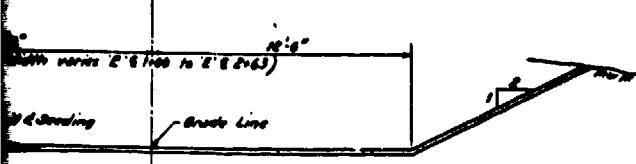


POND DRAIN TRASH RACK

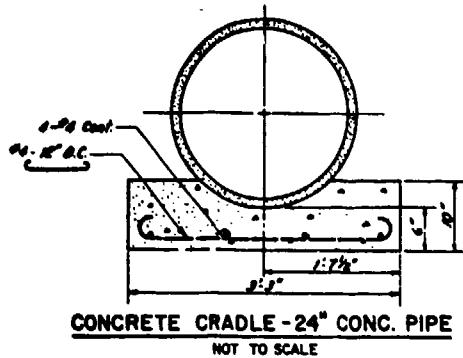
SCALE $1'' = 1'-0''$



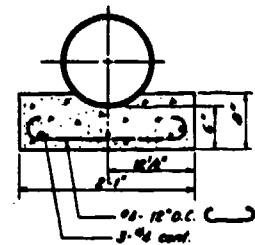
PRESTRESSED CONG
NOT TO SCALE



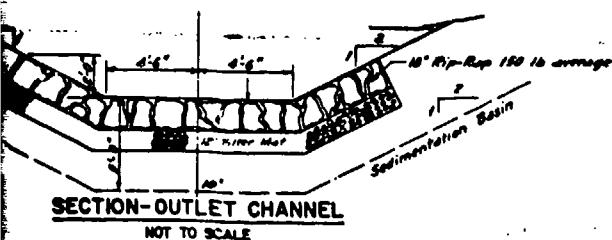
SECTION - EMERGENCY SPILLWAY
NOT TO SCALE



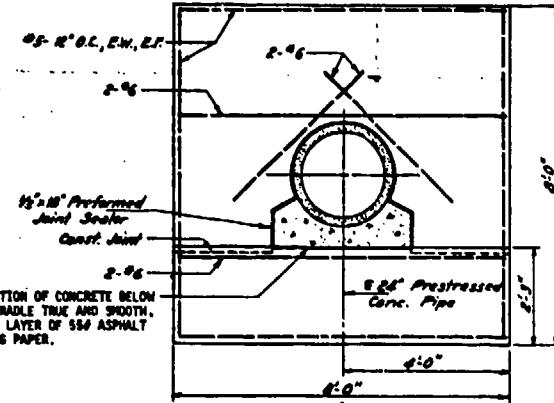
CONCRETE CRADLE - 24" CONC. PIPE
NOT TO SCALE



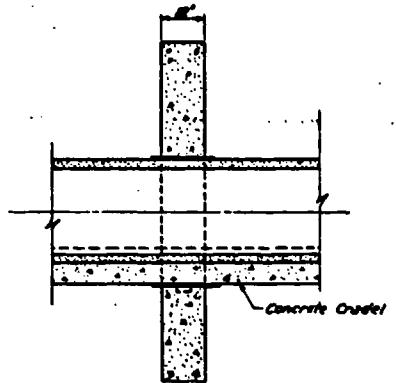
CONCRETE CRADLE - 12" D.I.P.
NOT TO SCALE



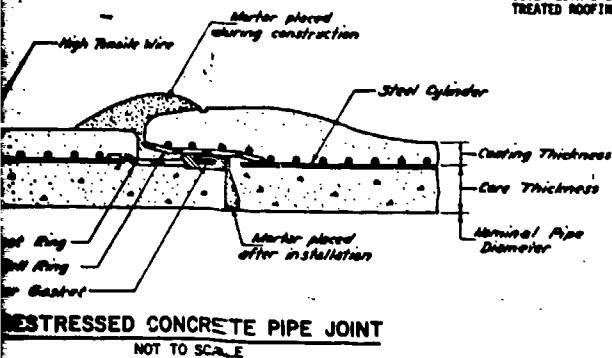
SECTION - OUTLET CHANNEL
NOT TO SCALE



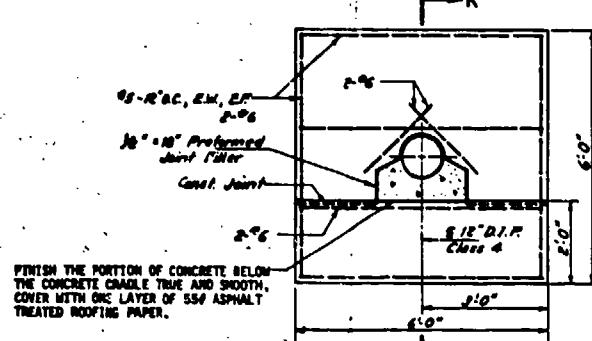
ANTI-SEEP COLLAR - 24" CONC. PIPE
SCALE $1/2$ " = 1'-0"



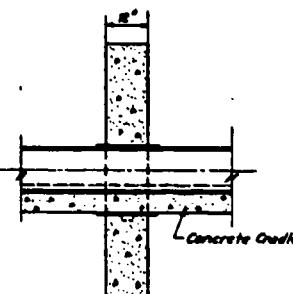
SECTION J-J



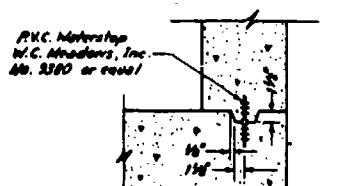
PRESTRESSED CONCRETE PIPE JOINT
NOT TO SCALE



ANTI-SEEP COLLAR - 12" D.I.P.
SCALE $1/2$ " = 1'-0"



SECTION K-K

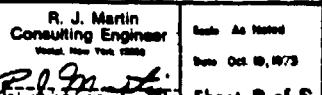


CONSTRUCTION JOINT DETAIL
RISER AND IMPACT BASIN
NOT TO SCALE

Revised March 11, 1974

A DAM FOR MESSRS. LEASURE,
LABONTE, NEILEY & MORSE
Silver Lake Township, Susquehanna Count., Pa.

MISCELLANEOUS DETAILS

| | |
|--|-------------------|
|  R. J. Martin Consulting Engineer World, New York, 1973  R. J. Martin Consulting Engineer World, New York, 1973 PE No. 674 | Scale As Needed |
| | Date Oct 10, 1973 |



Sheet 8 of 8

APPENDIX F

GEOLOGY

GENERAL GEOLOGY

Bedrock underlying this pond is interbedded light-olive-gray, very fine-grained sandstone; light-gray siltstone, and gray, silty shale. It is well bedded, thin to medium in thickness with some cross bedding. Joints in sandstone and siltstone are well developed and moderately spaced; rock weathers to flaggy and blocky fragments. Four surrounding quarries were operated for flagstone in the Catskill Formation.

Legend

(Bedrock)

D1h LOCK HAVEN FORMATION Interbedded olive-gray sandstone, siltstone, claystone, and thin conglomerate; marine fossils throughout.

Dck CATSKILL FORMATION UNDIVIDED Succession of grayish-red sandstone, siltstone, and shale generally in fining-upward cycles; some gray sandstone and conglomerate.

